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THE PLANT DISEASE BULLETIN

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THE PLANT DISEASE SURVEY

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SUPPLEMENT 10

Diseases of Field and Vegetable Crops in the United States in 1919

June 1, 1920

BUREAU OF PLANT INDUSTRY

UNITED STATES DEPARTMENT OF AGRICULTURE

PLANT DISEASE SURVEY

1919

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List of Collaborators of the Plant Disease Survey who have made the principal contribution to the 1919 annual summary.

It should be understood that many other collaborators and pathologists have assisted in gathering data within the states but the following list includes those who actually furnished state reports to the Washington office.

Alabama	Dr. G. L. Peltier
	Dr. E. F. Hopkins
Arizona	Prof. J. G. Brown
Arkansas	Dr. J. A. Elliott
	Prof. H. R. Rosen
Colorado	Prof. J. G. Leach
Connecticut	Dr. G. P. Clinton
Delaware	Dr. T. F. Manns
	Prof. J. M. LeCato
Florida	Dr. H. E. Stevens
	Dr. C. D. Sherbakoff
Georgia	Prof. J. B. Berry
	Prof. J. A. McClintock
Idaho	Prof. C. W. Hungerford
Illinois	Dr. H. W. Anderson
	Dr. F. L. Stevens
	Prof. G. H. Dungan
Indiana	Dr. M. W. Gardner
	Prof. H. S. Jackson
	Dr. G. N. Hoffer
Iowa	Dr. I. E. Melhus
	Dr. R. O. Cromwell
Kansas	Prof. L. E. Melchers
	Prof. H. H. Haymaker
Kentucky	Dr. W. D. Valleau
Louisiana	Dr. C. W. Edgerton
Maine	Dr. W. J. Morse
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Massachusetts	Prof. A. V. Osmun
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Michigan	Dr. E. A. Bessey
	Dr. G. H. Coons
	Mr. Ray Nelson
Minnesota	Dr. E. C. Stakman
	Dr. G. R. Bisby
Mississippi	Prof. J. M. Beal
Missouri	Dr. W. E. Maneval
	Prof. C. H. Philpott
Montana	Prof. D. B. Swingle
	Dr. H. M. Jennison
	Prof H. E. Morris
Nebraska	Dr. E. M. Wilcox
Nevada	Prof. C. W. Lantz
New Hampshire	Dr. O. R. Butler
New Jersey	Dr. M. T. Cook
New Mexico	Prof. L. H. Leonian
New York	Dr. Chas. Chupp
North Carolina	Dr. R. A. Jehle
North Dakota	Prof. H. L. Bolley
Ohio	Prof. A. D. Selby
	Prof. W. G. Stover
Oklahoma	Prof. C. D. Learn
Oregon	Prof. H. P. Barss
	Prof. C. E. Owens
Pennsylvania	Prof. C. R. Orton
Porto Rico	Mr. Julius Matz
South Carolina	Prof. J. L. Seal
South Dakota	Prof. Manley Champlin
Tennessee	Prof. S. H. Essary
Texas	Dr. J. J. Taubenhaus
Utah	Dr. G. R. Hill, Jr.
Vermont	Dr. B. F. Lutman
	Prof. A. H. Gilbert
Virginia	Dr. F. D. Fromme
Washington	Dr. F. D. Heald
	Mr. B. F. Dana
	Mr. A. M. Frank
West Virginia	Dr. N. J. Giddings
	Prof. Anthony Berg
	Dr. J. L. Sheldon
Wisconsin	Dr. R. E. Vaughan
	Prof. W. H. Wright

DISEASES OF FIELD AND VEGETABLE CROPS IN THE UNITED STATES IN 1919.

Prepared by

R. J. Haskell and Miss Jessie Wood.

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PRELIMINARY STATEMENT

Sources of Information.

This summary has been made possible by the receipt of a large number of reports on diseases gathered from various sources.

1. The collaborators of the Plant Disease Survey have supplied by far

the greatest amount of information. On June 1, 1920 collaborators numbered 96 and of these 46 were acting as chief collaborators for their resepctive states. All of these persons are paid only nominal salaries so that whatever contributions they make are largely voluntary. In most cases the chief collaborators sent in reports, but in some cases other persons were designated to prepare and submit the state summary. The list of names on the cover page are those of persons who made most of the reports to the Washington Office.

2. Plant pathologists of the Bureau of Plant Industry, particularly in the Office of Cotton, Truck and Forage Crop Disease Investigations, have contributed valuable information. In many cases their reports have already appeared in mimeographed form in the News Notes of the Office of Cotton, Truck and Forage Crop Disease Investigations, from which quotations have been made frequently in the following pages. The notes from Mr. D. G. Milbrath in California were esepcially helpful as these constituted most of the data received from that state. The quotations from Dr. G. K. K. Link on market diseases are also noteworthy.

3. The food products inspectors of the Markets Inspection Service conducted by the Bureau of Markets have collected a mass of data during 1919. These inspectors, of whom there are nearly 50 in number, located in about 24 of the larger cities, examine shipments of fruit and vegetable products on request of persons vitally concerned and prepare certificates giving the results of their inspection in detail. These certificates, showing the exact condition of the loads when they arrive at destination are filed in Washington with the Bureau of Markets and are made available to the Plant Disease Survey. During 1919 we have examined all of these certificates and extracted those data which show the percentages of decay of various kinds of fruit and vegetable rots. The results of this work are presented in the following pages. For the most part, they take the form of tables.

4. Miscellaneous reports, letters, extracts from publications, papers, etc., have been made during 1919 and some of the information gathered in this way has been used in preparing this summary.

The estimates of losses are largely those of collaborators, but plant pathologists of the Bureau of Plant Industry have also assisted and considerable revision has been made in the Plant Disease Survey Office. The estimates are necessarily rough but it is felt that they are an improvement over those of other years and are about as accurate as can be obtained at this time. The Survey has in preparation Supplement 12 of the Plant Disease Bulletin, which deals with crop losses from plant diseases during 1919. In this supplement percentage loss and also the reduction yield in bushels has been given. In some cases the figures in that supplement will not check with those in this present summary. This is on account of further revision of estimates. The figures in Supplement 12 are, therefore, the most accurate.

The Plant Disease Survey wishes to express its thanks to the collaborators and plant pathologists of the Department of Agriculture who have assisted in the preparation of this report by furnishing notes from time to time. It is hoped that even more persons will assist in the work of accumulating plant disease information during the present season and will send it in to the Plant Disease Survey for summarizing during the winter of 1920.

DISEASES OF POTATO

Late blight caused by Phytophthora infestans (Mont.) De Bary.

On the late crop, blighting of the vines and the accompanying rot were general in the northeastern part of the country as far west as Ohio and extending down the Appalachians as far as Northern Georgia. On the early crop the disease occurred destructively in Florida and somewhat along the coast in Georgia. Early potatoes farther north escaped blight for the most part.

The only other area of importance was that in Northern Wisconsin. Spotted occurrences were reported from South Dakota, the Upper Peninsula of Michigan, Ohio, and California, and certificates of market inspectors show late blight rot in shipments from Illinois, Iowa, Minnesota, Washington, and Oregon, although these reports were not substantiated by observations in the field. The accompanying map shows the range as reported to the Survey during the year.

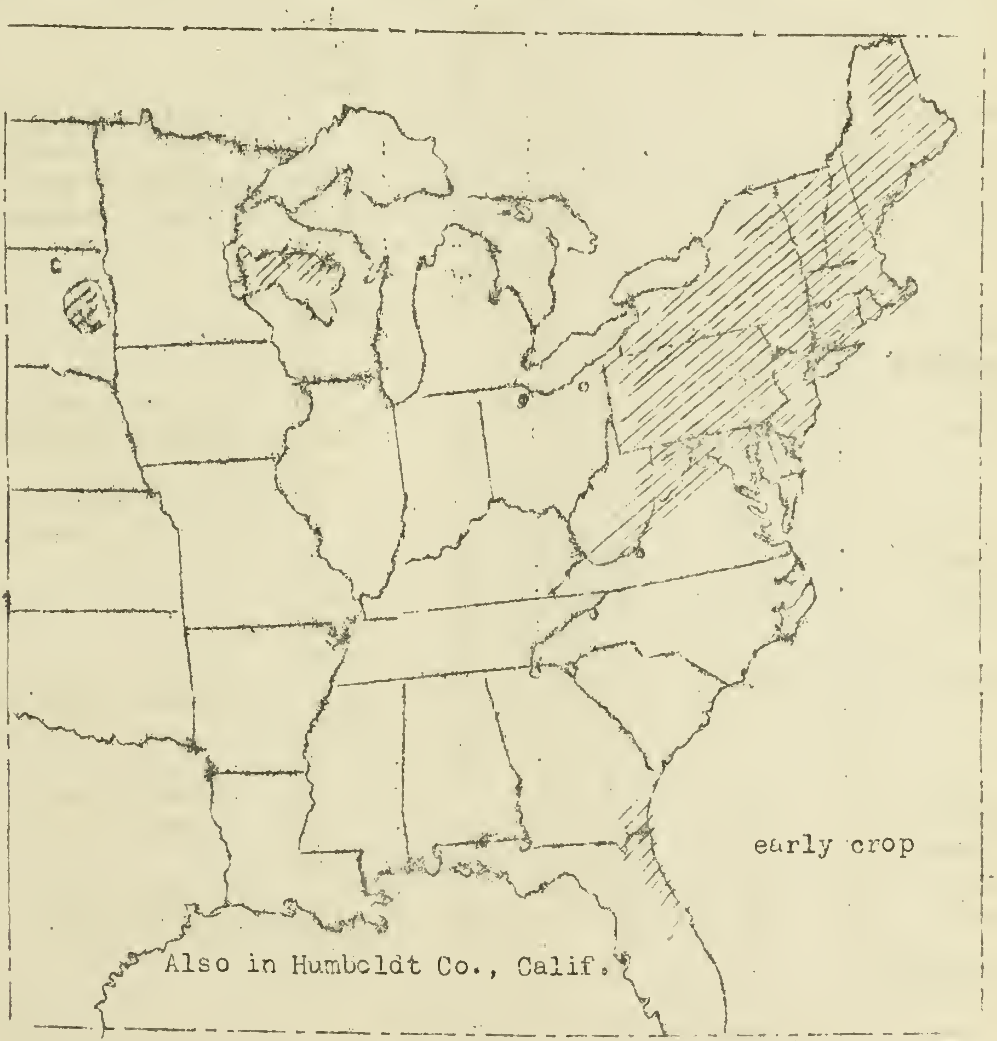

Fig. 30. Range of late blight and rot of potato in 1919 as ahown by field records. Shaded area indicates general infection and dots represent spotted occurrences.

As usual the disease was most abundant and destructive in New England, but this year the percentages of disease in Massachusetts, Rhode Island, and Connecticut probably exceeded that in the three states farther north. In Southern New England the disease was the worst it has been in years, and the loss in this section probably averaged about 25%. G. P. Clinton said that it was either the most serious, or next to the most serious, outbreak that Connecticut has experienced for the last eighteen years. Eastern New York, Pennsylvania, Maryland,

Table 54 Amounts of late blight rot in carload shipments as found and reported by inspectors.

Origin of shipment	No. of cars with rot	Average percentage of rot	Range of percentage of rot: No. of cars	Range of percentage of rot: Per cent	Remarks as to seriousness of rot.
Canada	195	10	173	1-25	
			15	25-50	
			7	50-75	
Florida	3	24	2	2	Occasional potato decayed.
			1	50	Very irregular decay.
Illinois	6	9	4	3-7	Slight decay.
			2	17-20	Decay irregular.
Maine	503	9	451	1-25	
			44	25-50	
			8	50-85	
Maryland	1	5		5	
Massachusetts	14	7		2-35	
Michigan	6	4		1-8	Slight decay in most cases.
Minnesota	32	11	29	1-25	Mostly slight decay.
			2	25-50	
			1	70	Decay varied from 25-100% in different sacks.
New Hampshire	1	9	1	8-10	
New Jersey	60	10	53	1-25	
			4	25-50	
			3	50-60	
New York	82	8	79	1-25	Mostly slight decay.
			2	25-35	
			1	50	
Ohio	1	2		2	Slight decay.
Pennsylvania	8	3		1-7	Slight decay.
Rhode Island	1	10		10	
Virginia	3	2		2	Slight decay.
Wisconsin	67	16	60	1-25	Slight decay.
			7	25-52	
Unknown origin	1	2		2	

Total .... 1000 Total number of cars inspected .... 5959 and West Virginia also suffered heavily. The disease was equally bad in New Jersey and Delaware on the late crop of potatoes, but as the early crop is the principal one the actual loss in these states was not so great as in those where late potatoes are more important.

A table giving percentages and bushels loss is given elsewhere in this bulletin, (Supplement 12, 1920), but for convenience a portion of it is presented here:

Table 55. Percentage loss from late blight in states where one or more per cent damage was incurred in 1919.

State	Per cent loss	State	Per cent loss	State	Per cent loss
Maine	10	New York	8	West Virginia	15
New Hampshire	20	New Jersey	5	North Carolina	1
Vermont	15	Pennsylvania	15	Georgia	2
Massachusetts	25	Delaware	5	Florida	15
Rhode Island	25	Maryland	10	Wisconsin	2
Connecticut	30	Virginia	2		

The disease was found abundantly in shipments of potatoes from the northeast portion of the country and from Canada. Table 54 shows the distribution of cars by states and the amounts of decay.

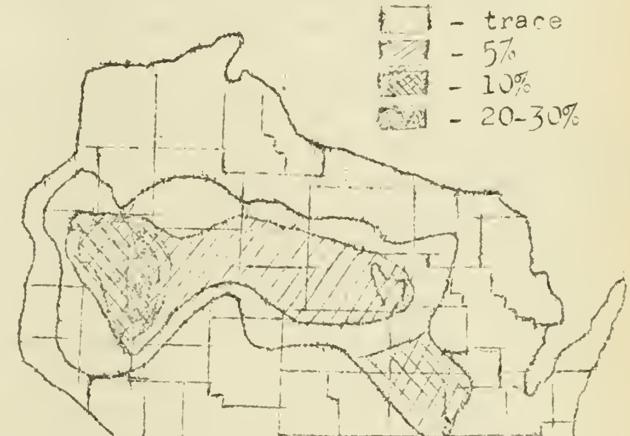

Fig. 31. Geographic distribution of late blight tuber rot in Wisconsin, 1919. After map prepared by W. W. Wright.

The loss to the early crop in the northern and central parts of Florida was heavy. The disease started there about the first of March and, favored by wet and cool weather, soon became epidemic. In the Hastings Palatka Section it is estimated that 20% loss was sustained, while for the state as a whole 15% loss is thought reasonable.

The disease apparently was not important in the Lake States except in Northern Wisconsin, where considerable vine and tuber injury took place. The accompanying map shows the region where the disease occurred on the tubers. A map showing the vine injury would be approximately the same. Killing of much of the foliage took place in Barron, Chippewa, Rusk, and Dunn Counties, and one-fourth total killing was evident on the heavier soils of Langlade, Lincoln, Marathon, Price, Taylor, Oneida, Burnette, and Polk Counties. Five to twenty-five per cent was evident on newly dug green potatoes in Barron and Chippewa Counties about September 12. County Agent R. F. Cuff of Barron County estimated that the loss to the farmers of Barron and Chippewa Counties from rotted tubers and loss in handling was at least $300,000. The following points regarding tuber rot were noted by W. H. Wright who followed the situation closely in Wisconsin last year:

(1) The severity of tuber rot was related to the sererity of the foliage injury.

(2) The foci of the infection in 1919 corresponded to the areas where the disease was observed in 1918.

(3) Very severe tuber rot was more or less coincident with the foci of primary infection in 1919.

Regarding the general situation in Wisconsin Wright reported as follows:

> "The development of late blight during the season of 1918 and 1919 indicated that the great potato growing sections of the state are probably never free of the disease, that is, it is epidemic. Such being the case, the danger from an epidemic developing will always be a possibility. Whether or not one occurs will always depend on soil and climatic conditions and on the efficiency of the control measures.
>
> "There cannot help being a large amount of infected seed planted in 1920. With an average season there are almost certain to develop many foci of infection early and spontaneously. In case of favorable weather conditions it is difficult to see how a general epidemic is to be prevented."

The influence of the weather on late blight in 1919 is worthy of note. In Florida, where the disease appeared earlier than usual (March 4), the weather was wet and cool much of the time from then until harvest, with the result that the disease became destructive. In Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New Jersey, Pennsylvania, and Maryland special mention is made of the fact that the disease was checked by the dry weather of late July and early August but became prevalent later in the season with the occurrence of wet weather in late August and September. In Wisconsin excessive rains during August, high humidity, low temperatures, and no killing frosts until October, all tended to accelerate blight and rot.

Table 56 gives the approximate dates when late blight was first seen by collaborators. These constitute all the dates given on report cards filed in the Survey Office. The literature has not been examined for dates of first appearance.

Early potatoes escaped for the most part in the northeastern late blight section. The disease developed too late to be of consequence on that crop. Clinton in Connecticut mentioned that some persons seemed to think that Dibble's Russet rotted less than other varieties and Vaughan in Wisconsin reported Rivals as more resistant than Green Mountains.

Results of spraying were reported as follows:

Florida: "Spraying with Bordeaux successful." (Sherbakoff)

New Jersey: "Bordeaux gave fine results." (Cook and Martin)

Pennsylvania: "Sprayed fields show little or no infection." (C. R. Orton, October 15.)

New Hampshire: "We have found that an 8-4-50 Bordeaux mixture applied every two weeks gave superior protection to a 4-4-50 mixture applied weekly and that Bordeaux mixture in which the ratio copper to lime is 1:1/2 gives better protection than those in which the more usual ratio 1:1 is employed." (Butler)

Vermont: "A number of farmers who did not give a late spray had a high percentage of rot." (Gilbert)

Connecticut: "In this state spraying has not come into general practice, partly because no farmers specialize on growing potatoes and we have no particular potato district. In general, I would say that fields that were sprayed thoroughly this year gave fair returns, but spraying did not cut down over 50% of the loss from the rot." (Clinton)

Table 56. Dates when late blight of potatoes was first noted by collaborators as shown by Survey records.

State	Date when disease was first reported to collaborators.													
	1903	1905	1906	1907	1908	1909	1912	1913	1914	1915	1916	1917	1918	1919
Me.					9-10	8-Lt						7-23	7-E	
N. H.			8-10									7-28	8-24	8-
Vt.		8-13	7-M								9-1	7-9	7-17	10-1
Mass.												7-25	8-8	7-24
Conn.	8-8										7-19	7-24	7-17	8-4
N. Y.		6-25	6-22		9-Lt		8-Lt		7-	6-23	8-2	6-20	7-16	
N. J.		9-5					10-24					7-15	7-15	
Pa.										8-16			7-15	7-17
Md.		8-1										8-1		
Va.							7-21	7-1					7-16	7-1
W. Va.												7-19	8-1	7-25
N. C.												5-		7-15
Ga.													5-25	6-10
Fla.		4-5	5-	4-			4-1					4-2		3-4
Ala.													4-1	
Ohio		7-15	7-	8-9	8-22		8-17			8-9		7-24		10-6
Mich.	8-M						7-							
Wis.		7-12	9-		8-				9-1	8-11	7-28		8-13	7-26
Minn.									9-6	8-5	8-12	7-13	7-17	11-3
Iowa		7-14											8-6	
Wash.							7-	5-30						
Ore.							8-20	9-15		6-Lt				

E = early in month, M = middle of month, Lt = late in month.

West Virginia: "We conducted potato spraying experiments and secured very satisfactory results. The experiments were conducted in a 20 acre commercial field and the increased yield amounted to approximately 50% as a result of spraying." (Giddings)

Early blight caused by Macrosporium solani E. and M.

Early blight was reported from practically all states where potatoes are grown. It was said not to have been found, however, in Washington and Montana, and it was not common in the northern parts of the other northern tier of states such as Minnesota, Michigan, Wisconsin, and Maine. It was common in almost all states and abundant in a number of them including New Jersey, Delaware, Kentucky, Tennessee, Ohio, South Dakota, and Colorado. Certain collaborators mentioned parts of their states where the disease was worst. Thus, in Florida it was especially common in the southern part and a similar condition was mentioned in New Hampshire. In Arizona it was worst in Coconino County, which is the largest potato section, and in Kansas it was epiphytotic in parts of the Kansas River Valley.

Regarding the situation in the Kansas Valley, J. W. Blachly reported as follows:

> "In my last trip to the Kaw Valley district June 17, I discovered that early blight had developed in a number of potato fields. In fact, there have been only a few outbreaks in the history of the Kaw Valley potato industry. The last one was in 1915 and did very little damage. In about 1908 several fields suffered quite severely. The present outbreak is by far the most severe of any. The disease is strictly a wet weather trouble.
>
> "Following is an estimate of damage done in certain parts of the Kaw Valley. This estimate was made by an examination of the maturity of the potatoes.
>
> Lenape, damage 35% over early estimate of yield.
> Loring, damage 35% over estimate 3 weeks ago.
> Edwardsville, Kansas, damage 35%.
> DeSoto, damage 35% from early blight and 15% from blackleg over the estimate three weeks ago.
> Williamstown, damage 20%.
> Perry, damage 25%.
> Topeka, damage 25% over estimate 3 weeks ago.
> Rossville, damage only slight.
>
> "A few of the growers sprayed their late planted potatoes and I believe they are receiving considerable benefit thereby. The Cobblers are not affected very much by blight, in fact, I do not believe there will be over 10% damage on the Cobbler crop. Dry weather is setting in now and I think it will aid the late planted potatoes; a great many of the early planted fields have completely lost their foliage and the rest of them will lose their foliage within the next few days. This seems to be the worst epidemic of early blight that has been in the Valley, in fact only one or two growers have had any experience with it before."

The losses from early blight were moderate on the whole and not so large as in 1918. The estimates of collaborators have been brought together and the percentage losses are given on the accompanying map. The losses in bushels will be given in Supplement 12, 1920.

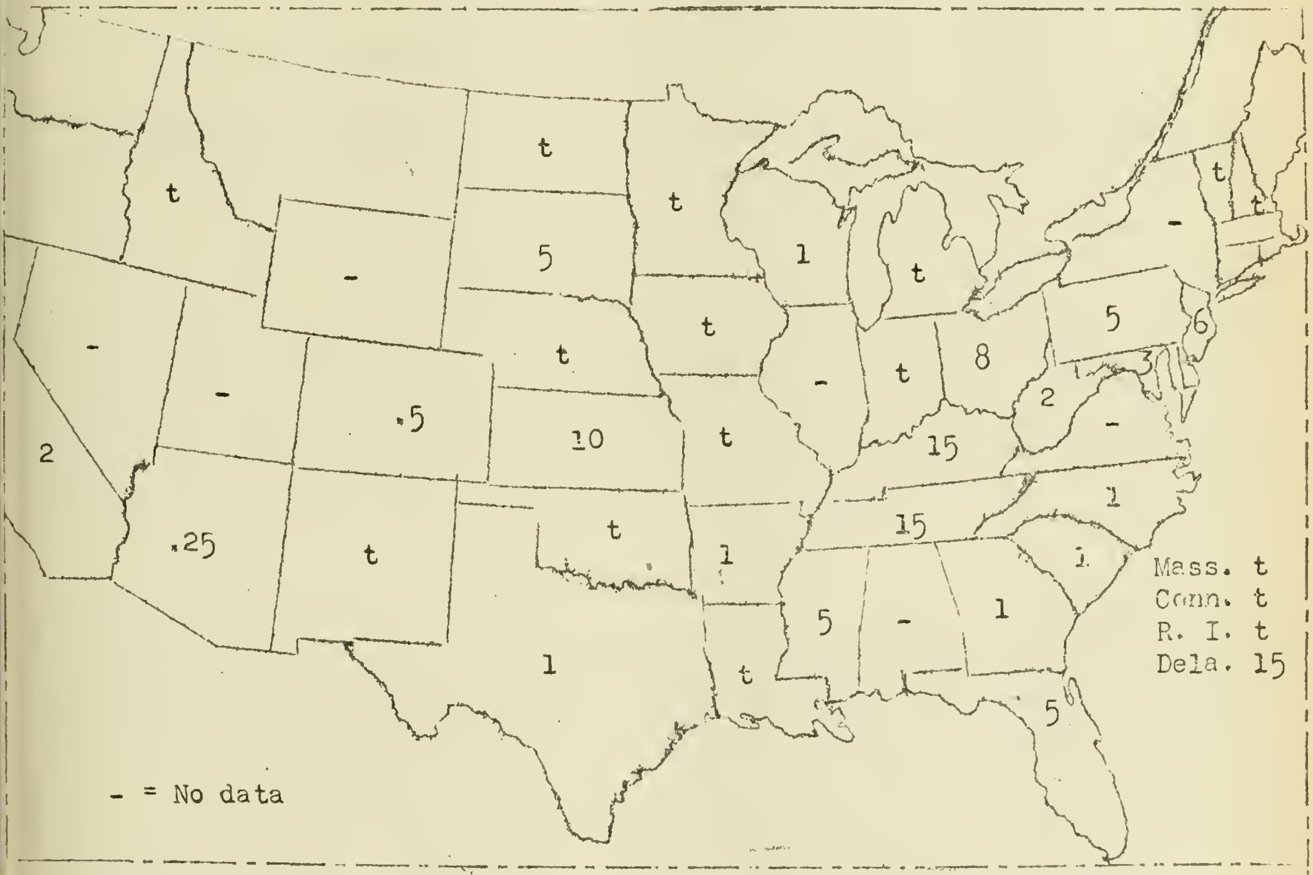

Fig. 32. Percentages reduction in yield of potatoes from early blight, 1919. (See also Pl. Dis. Bul. Supl. 12, 1920).

Dates of earliest recorded appearance in 1919.

March 31 ...... Florida
April 18 ...... Mississippi
May .... Arkansas (on early potatoes)
May 13 .... Tennessee
" 15 .... South Carolina
" 28 .... Georgia
" 28 .... Arkansas
June .... Maryland
" 8 .... Oklahoma

June 14 ...... Indiana
July 16 ...... Minnesota
" 25 ...... Connecticut
" 28 ...... Maine
" 28 ...... Wisconsin
August .... N.Hampshire
" 20 ...... Colorado
September .... Arkansas (on late potatoes)

The disease was nearly always reported worst on the early varieties such as Irish Cobbler. Late maturing potatoes like those of the Rural and Green Mountain groups as a rule were not badly attacked.

In a number of states difficulty is experienced in controlling this disease with Bordeaux. Thus in Georgia nearly as much injury took place on certain sprayed fields as on those that were unsprayed. In Florida, Bordeaux was not entirely successful. On the other hand Tennessee, and also Wisconsin, reported success with Bordeaux when carefully and thoroughly applied.

Fusarium wilt caused by *Fusarium oxysporium* Schlecht.

This disease occurred to a greater or less extent in practically all states where potatoes are grown with the possible exception of northern New England, but injury was not severe except locally in some of the states occupying a belt through the middle portion of the country. For the United States as a whole the disease was probably about as prevalent as in 1918, but in Colorado, owing to a dry summer, there was considerably less than usual and in Minnesota it was also below normal. On the other hand in some of the states farther west such as California, Nevada, and Idaho, the disease seemed to be fully as destructive if not more so than in the previous year.

Estimates of the reduction in yield from Fusarium wilt have been made by states and the losses in percentages and bushels will be given in Plant Disease Bulletin, Supplement 12, 1920. For convenience the tentative percentage estimates are also given on the accompanying map. These figures are subject to revision.

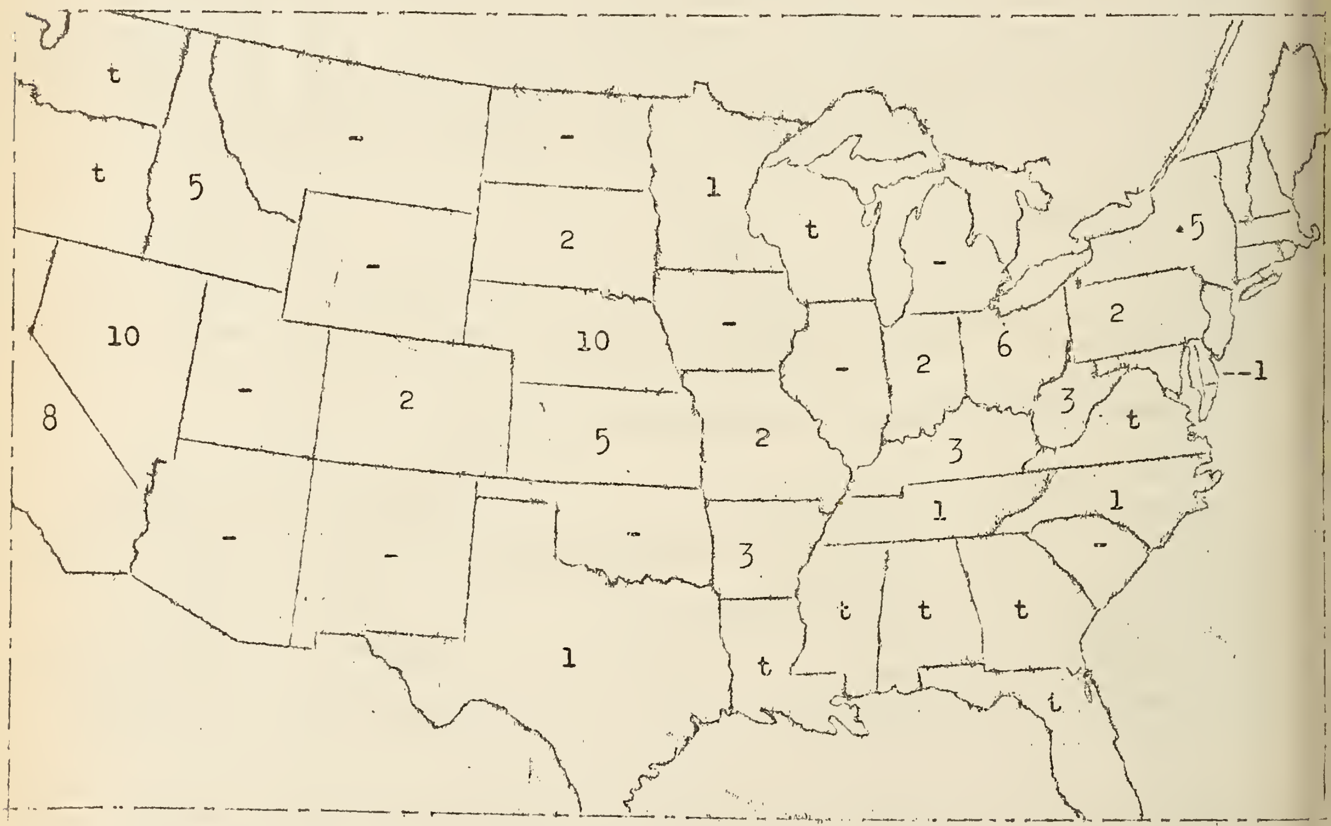

Fig. 33. Percentages reduction in yield of potatoes from Fusarium wilt, 1919. (See also Pl. Dis. Bul. Supl. 12, 1920).

The dates when the disease first began to appear on the vines were given by collaborators as follows:

July .... Arkansas
" 12 .... Colorado
" 18 .... Indiana
" 28 .... Tennessee
August 8 .... Ohio
" .... Wisconsin
September 23 .... Minnesota

The variety Burbank was reported most susceptible in Nevada.

Practically no headway seems to have been made commercially in the control of Fusarium wilt.

Verticillium wilt caused by Verticillium albo-atrum Reinke and Berth.

This wilt disease was reported from Maine, North Dakota, and Oregon. In Northern Maine it was found by M. Shapovalov in at least two large commercial fields, one at Ft. Fairfield and the other at Houlton, where affected plants ranged from 5-15% in different parts of the fields. In Oregon no especial search was reported, but it was said to be present in about the same amounts as usual.

Bacterial wilt caused by Bacterium solanacearum E. F. S.

The range of this disease in 1919 was distinctly southern as usual. It was reported from North and South Carolina, Florida, and Arkansas. In no state was it particularly destructive although it was present in about 10% of the fields in North Carolina and caused rather heavy losses locally in Florida.

Stem rot and scurf caused by Corticium vagum solani Burt.

This disease was reported in 1919 from all states except Vermont, Rhode Island, Connecticut, West Virginia, Kentucky, Tennessee, Mississippi, Illinois, Wyoming, New Mexico, Utah, and Oregon. It undoubtedly occurred in those states but escaped being reported.

In general it was not so abundant as usual. This falling off in Wisconsin was attributed to too hot weather by R. E. Vaughan, and in Montana it was thought that drought was the reason for the decrease.

The losses which were below normal, occurred chiefly because of missing hills, uneven stands and "little potatoes". The estimated percentage loss by states is indicated on the map in Fig. 34. The losses in bushels will be found in another supplement of this publication (Pl. Dis. Bul. Supl. 12, 1920).

Approximate dates when disease was first noticed on vines according to collaborators:

May 15 .... South Carolina
June 2 .... Missouri
June 9 .... Colorado
June .... Wisconsin
July ....Arkansas
July 17 ....Pennsylvania
August 3 ....New Hampshire
August 15 ......Indiana

In Iowa the disease was said to be worse on Early Ohio than on Rural

New Yorker, while in Wisconsin the Rural group seemed to be more affected than the Green Mountain.

Disinfection with corrosive sublimate is mentioned in a number of states as being very satisfactory and no unfavorable comments were received. Collaborators were asked to give a rough estimate of the percentage of growers treating potato seed and the following replies were received:

Vermont: "Over 50%."

Virginia: "Very few."

West Virginia: "Probably 20% or more."

Tennessee: "Ten per cent."

South Carolina: "Very few."

Louisiana: "Not more than 10%."

Ohio: "Eighty per cent."

Michigan: "Probably 10%."

Minnesota: "Probably 10 or 20%. Definite figures not available." (Bisby)

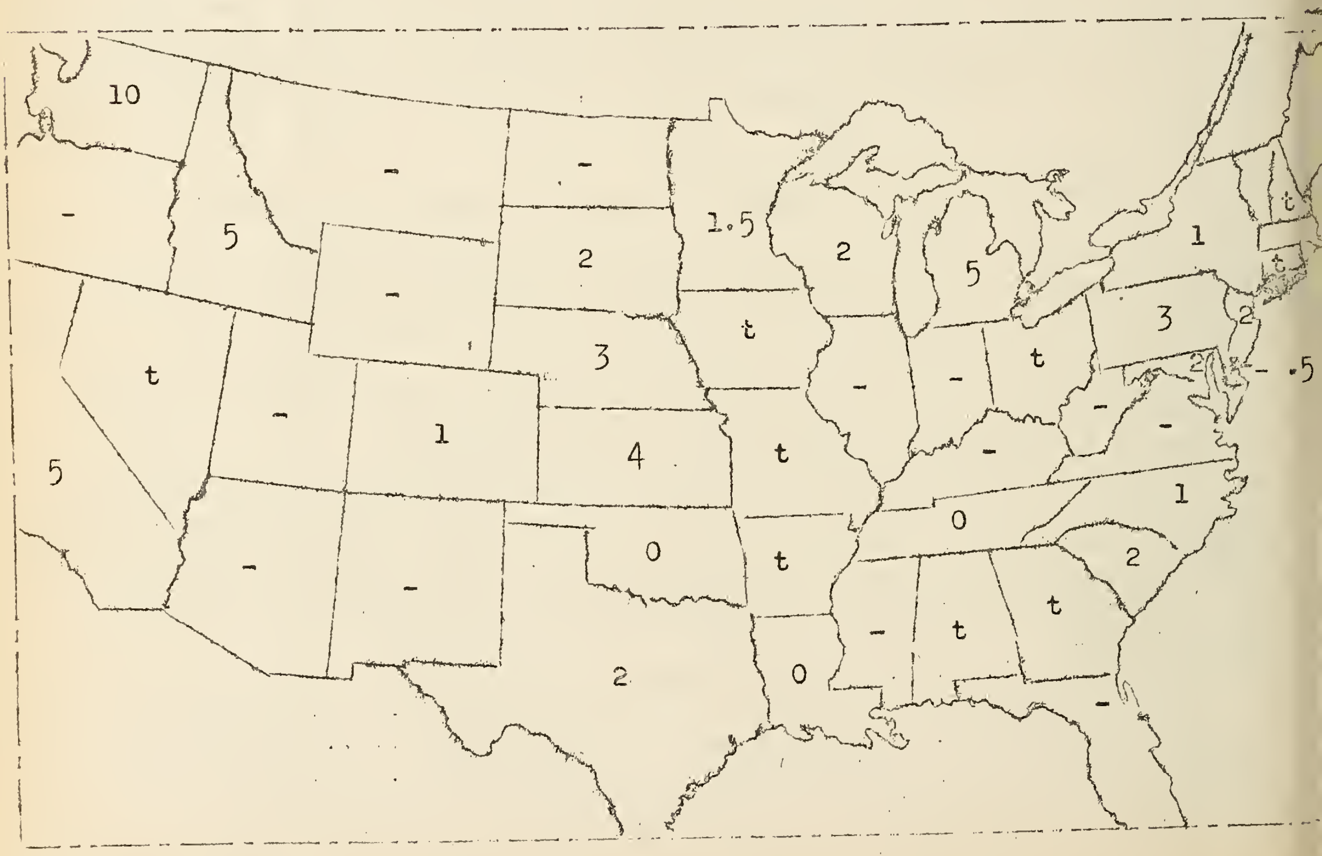

Fig. 34. Estimated percentages loss from Rhizoctonia on potato in 1919.

Missouri: "Likely very few." (Maneval)

Kansas: "About 15% of the potato seed planted is treated." (Melchers)

Colorado: "Probably not more than 10%."

Nevada: "Twenty-five per cent." (Lantz)

Idaho: "About 50% of growers disinfect potatoes, using corrosive sublimate." (Hungerford)

Washington: "General for commercial growers; rare for the home garden."

California: "Quite general." (Smith)

Scab caused by *Actinomyces scabies* (Thax.) Güssow.

Scab was common as usual. A number of states such as New Jersey, Delaware, Ohio, and Tennessee reported more than last year, while other states like Connecticut, Colorado, and Oklahoma reported considerably less.

It was also said to be especially bad in certain sections of many states. Thus, in the southeastern part of Delaware it did a great deal of damage and in parts of Southern Idaho it was serious.

Estimates of injury as made by collaborators are given in the following table:

Table 57. Percentages of injury and loss to potatoes from scab, 1919.

State	Percentage of injury	Percentage loss	State	Percentage of injury	Percentage loss
Vermont	25-50	10-15	Arkansas	5	-
Pennsylvania	10-15	4-5	Wisconsin	-	3
West Virginia	10	2	Iowa	-	15-20
South Carolina	10	1	South Dakota	25	5
Georgia	15	2	Nebraska	-	5
Mississippi	-	5	Nevada	2	-
Louisiana	10	high	Idaho	10	2
Texas	-	5			

Soil temperature has recently been shown to be an important factor in scab development (Jones, L. R. and McKinney, H. H. Phytopath. 10: 63, 1920). It is very probable that geographic distribution and variations in amount of scab from year to year may be explained partially on this basis. Soil type is also a factor to be considered and made the subject of study. McMillan in Colorado reported more scab on sandy land, while Gardner in Indiana noted it as very prevalent on heavy soils.

Early varieties were said to be most affected in Wisconsin and Colorado. The Rural New Yorker in the former state seemed to be the most resistant. In

Minnesota it was said that, "Early Ohio is grown more than any other one variety, and is often very heavily scabbed."

Regarding seed treatment, collaborators were asked to give any results that they may have experienced with warm formaldehyde or warm corrosive sublimate. The replies were as follows:

> Vermont: "Results seem to be satisfactory. Mercuric chloride method good."
>
> Connecticut: "In general, formalin is the treatment given for scab on potatoes, and as yet, so far as I know, no attempts have been made to use it in the warm and stronger form." (Clinton)
>
> Arkansas: "Laboratory test did not show warm formaldehyde to be satisfactory for Rhizoctonia that could be controlled by corrosive sublimate or by soaking in formaldehyde." (Elliott)
>
> Ohio: "No experimental tests, favorable results reported by a few growers." (Selby)
>
> Michigan: "Warm formaldehyde treatment satisfactory in our local plots for scab, not for Rhizoctonia."
>
> Minnesota: "Not yet used by growers. Experiments here did not indicate the necessity for heating formaldehyde and our experience with hot water grain treatment indicates that growers will not take particularly kindly to it." (Bisby)

In Wisconsin corrosive sublimate is considered more satisfactory than formaldehyde, according to R. E. Vaughan.

It is estimated that 5-10% of the farmers in Pennsylvania, and 25% in Nevada, treated their seed last year before planting.

Black leg caused by Bacillus atrosepticus Van Hall.

Black leg occurred widely in 1919, it being reported from Maine, Vermont, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, North Carolina, Georgia, Ohio, Indiana, Michigan, Wisconsin, Minnesota, Iowa, Arkansas, North Dakota, South Dakota, Nebraska, Kansas, Montana, Colorado, Arizona, Idaho, Washington, and Oregon.

A number of states such as Connecticut, Wisconsin, Minnesota, Nebraska, and Washington reported less than usual. This was attributed to the dry summer in Nebraska.

The losses in the main potato sections were not heavy, as a rule, although in Kansas, Arkansas, Nebraska, and Idaho estimated losses of 10, 4, 2, and 3% respectively were sustained. L. E. Melchers found this to be the most serious tuber borne disease in Kansas and J. W. Blachly reported the following regarding the outbreak in the same state:

> "The past week I inspected about 25 potato fields and ten market garden tracts in the Kaw Valley. In the potato fields I found from 5% to 25% black-leg. In one of the treated fields at Edwardsville, Kansas,

treated stock on probably 20 acres showed only a trace of black-leg, while untreated fields showed 5%, and seed from another lot showed 10%.

"At Muncie, Kansas, I found a field which had about 18% black-leg injury and also was showing about 30% loss from Rhizoctonia. This section has had excessive rainfall and the growers are a little discouraged. At Turner, Kansas, a few miles from Muncie, I found from 5 to 10% black-leg, and at De Soto, Kansas, I found an average of 5%.

"At Topeka I went over the whole section. Mr. Kelsey's 110 acres of treated stock showed a trace of injury from black-leg. A field of 60 acres of untreated seed showed from 5 to 10% injury from black-leg. The average yield from this district, however, should be close to 250 bushels, and in some fields it will average 300 bushels."

In Aroostock County, Maine, only traces were found except in one large field where about 5% occurred.

Judging from the reports the disease was most abundant last year in the West. Collaborators in Montana and Colorado say it was particularly bad in the western part of their states. In Oregon as high as 25% was reported in individual fields. Estimates of losses by states will be found in Plant Disease Bulletin 12, 1920.

The earliest dates of recorded appearance were:

May 20	Washington
June 1	Georgia
" 1	Maryland
" 12	Iowa
" 17	Indiana
June	Wisconsin
July 5	Minnesota
" 8	Colorado
August	Ohio

Seed treatment with corrosive sublimate is mentioned as giving good results in Wisconsin, Kansas, and Idaho. The evidence collected by Blachly in Kansas is given above. Melchers in the same state says,-

> "In untreated seed the amount varied from 1-35%. Seed treated with corrosive sublimate gave almost perfect control."

C. W. Hungerford in Idaho gave the following illustration bearing on the subject:

> "A striking instance of the value of seed treatment for black-leg was shown at Idaho Falls. A grower treated with $HgCl_2$ but ran out of solution and planted a few rows with no treatment. Where treated, less that 1% of black-leg and where not treated 35% of the plants were dead or dying June 27."

Wart caused by *Chrysophlyctis endobiotica* Schilb.

The discovery of potato wart in Pennsylvania in 1918 immediately gave rise to the question, How widely has this new disease become established in the United States? Before practical control measures could be effectively and wisely applied a knowledge of the approximate distribution of the disease was absolutely essential. It was, therefore, arranged that the Plant Disease Survey, in cooperation with the state experiment stations, state departments of agriculture and the Federal Horticultural Board, should conduct a country-wide search for wart in 1919.

The survey was organized and started in the southern states in June when early potatoes were being dug, and was continued in the northern states until potato harvesting was over. In Minnesota, Nebraska, Kansas, Oklahoma, Texas, and all states east, a survey man was assigned to each state to work under the direction of the state collaborator. In Pennsylvania, West Virginia, Ohio, and New York, where the search was most concentrated, a group of men worked in each state; while in the states west of the 100th meridian no actual surveying was done but the state collaborators gave the matter considerable publicity.

The survey for the newly introduced disease had two phases; the publicity campaign and the garden inspection.

The publicity campaign. Illustrated printed matter in the form of circulars and post cards was provided and somewhat over a million of the latter were distributed during the season. As many as possible of the officials, individuals, and agencies that could aid in the search for wart, were personally visited and their assistance secured. Among those who became interested, and who actively cooperated, may be mentioned experiment station workers, the extension service, including county agents and home demonstration agents, state departments of agriculture, college professors, school teachers, school children, garden clubs, etc., postmasters, newspapers, potato dealers, potato associations, boy scout organizations, gardeners, and farmers, etc. Much effort was put into this work which was fully justified by the results, for of the eight new discoveries of wart, four resulted from this educational campaign.

Garden inspection. In localities where wart was strongly suspected to occur considerable garden search was made. This phase of the work was conducted particularly in Pennsylvania and neighboring states, especially after new occurrences of wart began to be found.

In Pennsylvania the cooperative work was divided between the State

Table 58. Summary of potato wart survey by Pennsylvania State Department of Agriculture in the western coal area of Pennsylvania, 1919.

County	Number of towns and villages.	Total number of gardens in these	Gardens with potatoes visited.	Gardens with wart	Acres	Bushels
Allegheny	24	1,224	209	0	22	669.25
Armstrong	7	831	758	0	1	293
Beaver	1	1,500		0		
Butler	5	450	285	0	5.5	21.75
Fayette	35	7,090	36	0	73	2,895
Greene	13	1,077		0	3.25	794.25
Indiana	2	53	11	0	5	108
Lawrence	3	3,425		0		34.5
Somerset	1					1,200
Washington	34	3,375	474	0	77	988
Westmoreland	52	8,389	799	0	317.75	2,900.25
Total	177	27,914	2,572		504.5	10,084

Department of Agriculture and the Agricultural Experiment Station. The State Department, under the direction of W. A. McCubbin, surveyed the country surrounding the infested area in Eastern Pennsylvania and also made an intensive survey in certain counties in the western part of the state as shown in Table 58.

The Pennsylvania State Agricultural Experiment Station, cooperating with the Plant Disease Survey, intensively surveyed certain towns and villages in the west-central part of the state. The scope of their operations is shown in the following table:

Table 59. Extent of intensive wart survey work in West-central Pennsylvania, 1919.

County	Number of towns and villages.	Number of gardens	*Number of gardens inspected	Acres inspected
Cambria	30	2,760	1,152	207
Center	3	410	290	44
Clearfield	23	1,485	914	146.5
Bedford	1	50	9	2
Huntingdon	2	70	48	5
Indiana	4	190	65	9
Jefferson	9	405	205	33
Somerset	14	537	286	39.2
Westmoreland	3	120	71	13
Total	89	6,027	3,040	498.7

In West Virginia garden inspection and publicity work were conducted in what were considered to be the most important places. The following table shows the number of towns visited by counties.

Table 60. Number of towns visited in potato wart survey in West Virginia, 1919.

County	Number of towns	County	Number of towns	County	Number of towns
Barbour	3	McDowell	4	Preston	15
Berkeley	2	Mason	2	Raleigh	3
Brooke	3	Mercer	5	Randolph	7
Cabell	1	Mineral	2	Summers	1
Fayette	6	Mingo	5	Taylor	1
Grant	4	Monongalia	2	Tucker	16
Jackson	1	Morgan	2	Wayne	3
Kanawha	2	Ohio	1	Wood	1
Logan	1	Pocahontas	3		

---

*This is approximately the total number of gardens where potatoes were grown.

Results. As a result of the nation-wide survey in 1919 wart was discovered in six villages in Western Pennsylvania and in two in Northern West Virginia. The accompanying table shows the important data regarding the new findings.

Table 61. New locations of potato wart infestations in Western Pennsylvania and Northern West Virginia, as determined by the potato wart survey, 1919.

State	County	Town	Date wart was found	Number gardens infested	Finder
Pennsylvania	Cambria	Nanty Glo	Aug. 27	2	L. E. Yocum
		Lilly	Sept. 13	1	H. S. Stahl
		Vintondale	Sept. 27	2	C. L. Farabaugh
		Llanfair	Sept. 23	10	A. J. Garretson
	Clearfield	Osceola Mills	Oct. 8	5	C. L. Farabaugh and party.
	Center	Clarence	Oct. 15	2	C. L. Farabaugh and R. L. Mankey
West Virgina	Randolph	Whitmer	Sept. 9	1	E. Angelo and H. C. Daniels
	Tucker	Thomas	Sept. 12	11	E. Angelo

All six villages where wart was found in Pennsylvania are mining settlements in the bituminous section of the state and are inhabited largely by foreigners. Thomas, West Virginia, is also a soft coal mining village, while Whitmer is a small saw-mill settlement and is the only point of infestation found outside the mining area. The complete findings regarding the occurrence of wart are illustrated on the accompanying map.

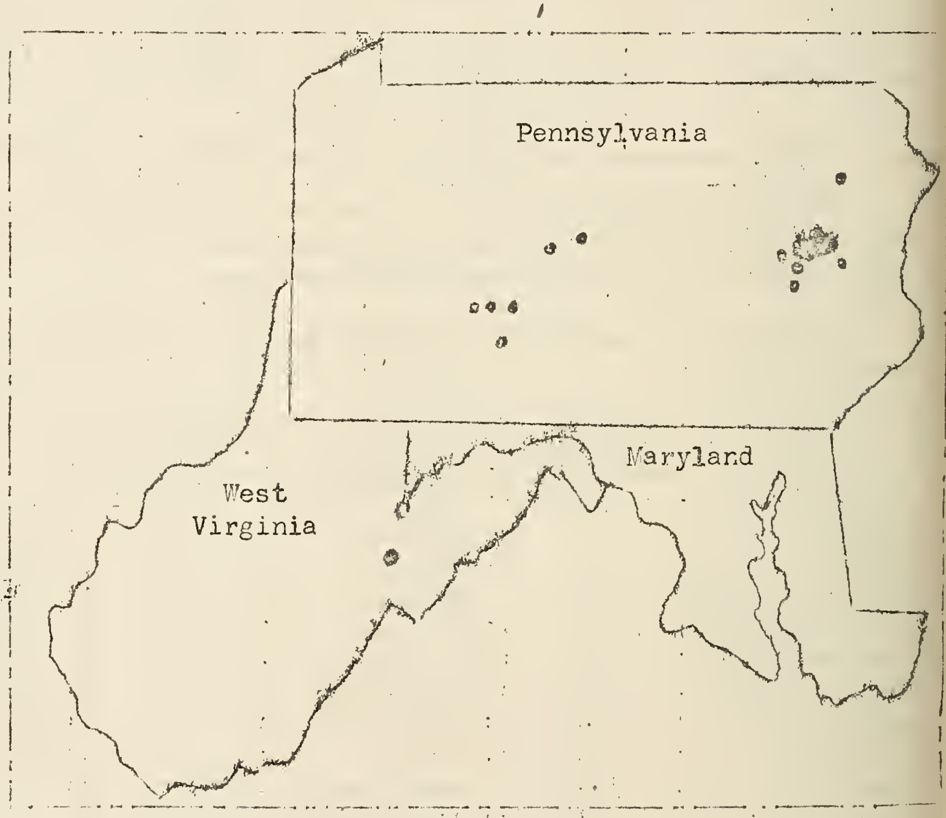

Fig. 35. Outline map showing present known geographic distribution of potato wart. Each dot signifies a village where the disease has been found. The augular area in Eastern Pennsylvania represents the original Hazleton-Freeland quarantined district.

During the summer field men of the Pennsylvania State Department of Agriculture, who intensively surveyed the country surrounding the original Freeland District, further delimited that area and found some outlying infestations. The accompanying map showing the distribution of the disease in this part of the state has been supplied by W. A. McCubbin of the Pennsylvania State Department of Agriculture.

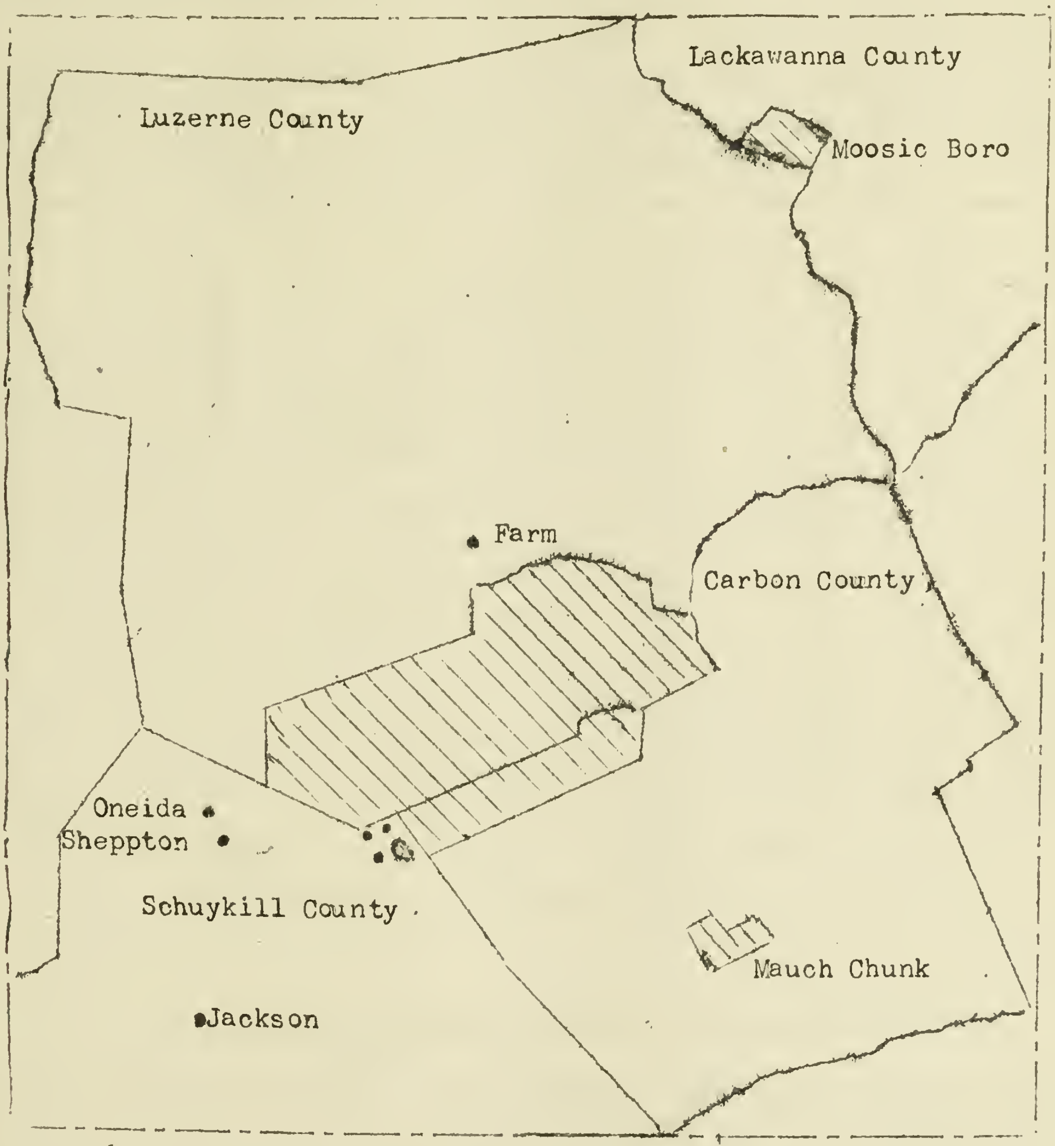

Fig. 36. Areas in Eastern Pennsylvania where potato wart has been found and which are quarantined on account of the disease.

It is rather significant that all of the occurrences of wart found thus far have been in or near coal mining villages. It is also significant that all of the eight new locations discovered in 1919 are small and in no way comparable to the extensive Eastern Pennsylvania District, which, after the survey of the past season, can probably be said with certainty to be the largest wart infested area in the United States. Small areas, however, might easily have escaped discovery so that further search should be made, and a vigilant watch maintained for other appearances of the disease.

Fusarium tuber rot caused by Fusarium spp.

Both the dry and wet types of Fusarium rot were common in shipments of potatoes in 1919. Out of the 5959 cars of potatoes inspected 1069 showed Fusarium tuber rots in varying amounts.

Table 62. Percentages of Fusarium tuber rot in cars of potatoes as determined by market inspectors, 1919.

Origin of shipment	Number of cars with decay	Average percentage of decay	Origin of shipment	Number of cars with decay	Average percentage of decay
Arkansas	1	20	Missouri	13	7
California	27	5	Montana	18	4
Canada	67	7	Nebraska	15	9
Colorado	92	9	New Jersey	49	8
Florida	8	4	New York	28	4
Idaho	51	8	North Carolina	16	14
Illinois	43	13	North Dakota	24	6
Indiana	2	7	Ohio	6	5
Iowa	2	2	Oklahoma	7	4
Kansas	10	7	Oregon	14	8
Kentucky	4	44	Pennsylvania	11	3
Louisiana	4	38	South Dakota	4	8
Maine	77	3	Texas	17	8
Maryland	7	18	Utah	8	7
Massachusetts	10	10	Virginia	13	19
Michigan	98	4	Washington	23	5
Minnesota	209	5	Wisconsin	75	6
Mississippi	1	10	Wyoming	5	15
			Unknown	10	11
			Total	1069	

Total number of cars inspected 5959

Jelly end rot caused by Fusarium radicicola Wr.

This rot injured as high as 25% of the tubers in some fields of Southern Idaho and is thought to have caused a loss of about 1% of the crop of that state. It was also reported from Washington.

Potatoes with jelly ends, thought by inspectors to be due to F. radicicola, were also found on the market from California (4 cars), Idaho (11 cars), Illinois (3 cars), Minnesota (1 car), New Jersey (3 cars), Oklahoma (1 car), and Washington (1 car). The decay in all these shipments ranged from 1 to 13% and averaged 6.2%.

Powdery dry rot caused by Fusarium trichothecioides Wr.

Powdery dry rot probably destroyed 10% of Nebraska's potato crop in storage during the winter of 1918-1919. What was thought to be this rot was reported by market inspectors in shipments of potatoes from Michigan (1 car 4%), Wisconsin (2 cars 8 and 12%), and Minnesota (1 car 10%).

Root knot caused by Heterodera radicicola (Greef.) Müll.

Nematode injury to potato tubers was reported from Delaware (one case), Virginia, Georgia, Florida, Alabama, Arkansas, Texas, and Nevada. Most of these states received an unusually large number of specimens of this trouble last year on account of the publicity given to potato wart. Many growers suspected the swellings caused by nematodes as being wart.

Tip burn (non-parasitic) and hopper burn induced by leaf hoppers.

Tip burn occurred widely in 1919. Along the Atlantic Coast in the eastern part of the country it was not so prevalent as during the previous season. In California, it was also said to be less than usual. In the North Central states, however, the condition was serious. Thus Indiana reported it the most important potato trouble, injuring 70% of the crop and causing a loss of at least 3% of the crop. In Michigan tip and hopper burn was exceedingly common everywhere, cutting the yield of potatoes on the Upper Peninsula almost in two

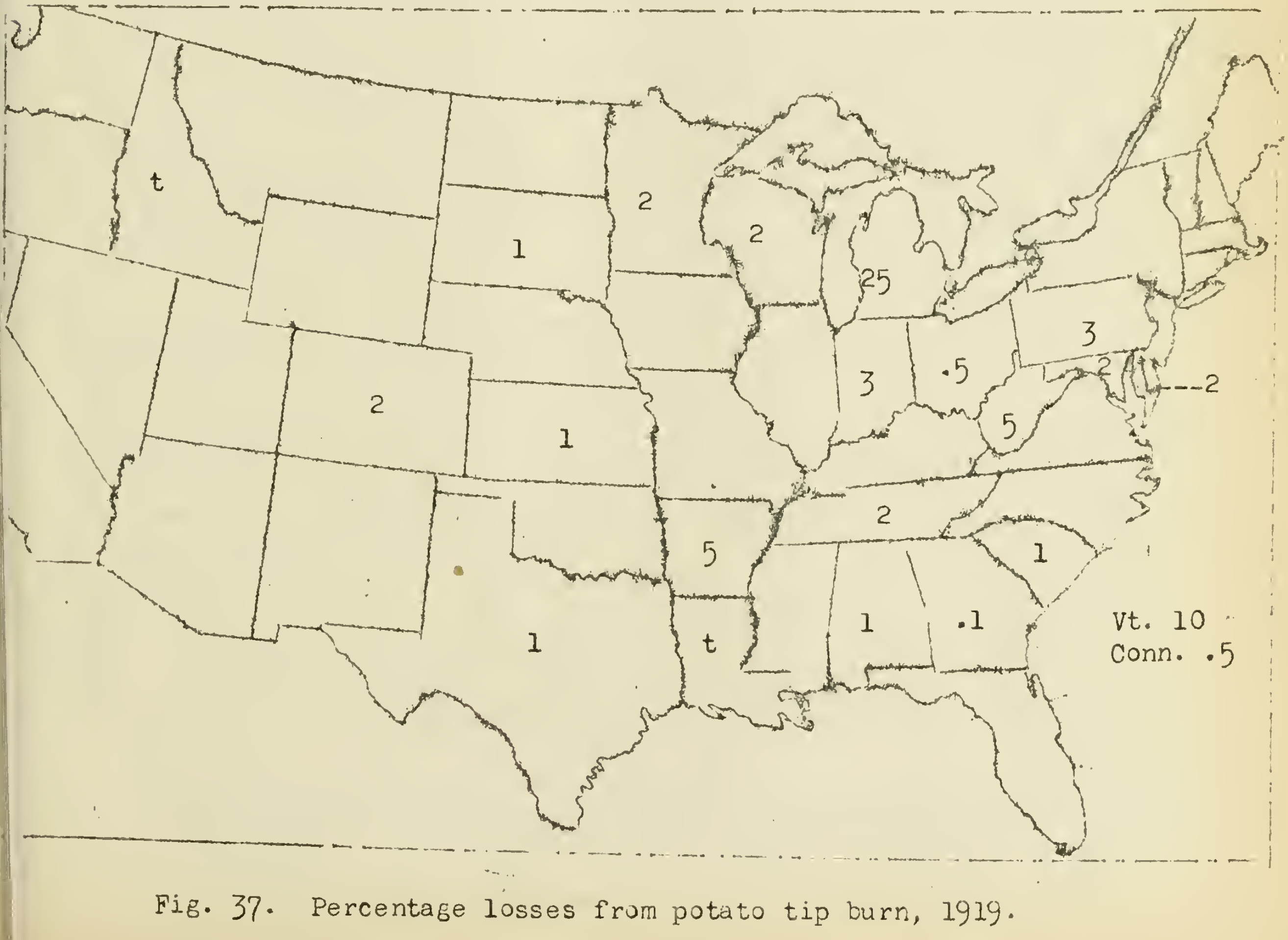

Fig. 37. Percentage losses from potato tip burn, 1919.

and causing the state's early crop to turn out a failure. In Iowa, Southern Wisconsin, and parts of Missouri, Kansas, and Colorado the injury was serious.

Estimates of losses from tip burn have been made and a table showing percentages and bushels reduction in yield will be found in Plant Disease Bulletin Supplement 12, 1920. The map in Fig. 37 shows the distribution of losses.

As usual the early varieties suffered most. Early Ohio in Missouri and Iowa, and Bliss Triumph in Pennsylvania, Wisconsin, and Iowa were mentioned as being badly injured.

When applied early and thoroughly, Bordeaux mixture was helpful in reducing the amount of tip burn in Indiana and Wisconsin.

Mosaic (cause undetermined).

Mosaic was reported from practically all states in 1919. In some states, especially those in which susceptible varieties are not common, the disease was of very little importance, but in others, where potatoes like Triumph, Green Mountain and American Giant are the principal commercial varieties, the losses were considerable.

The accompanying map shows the distribution of losses by states.

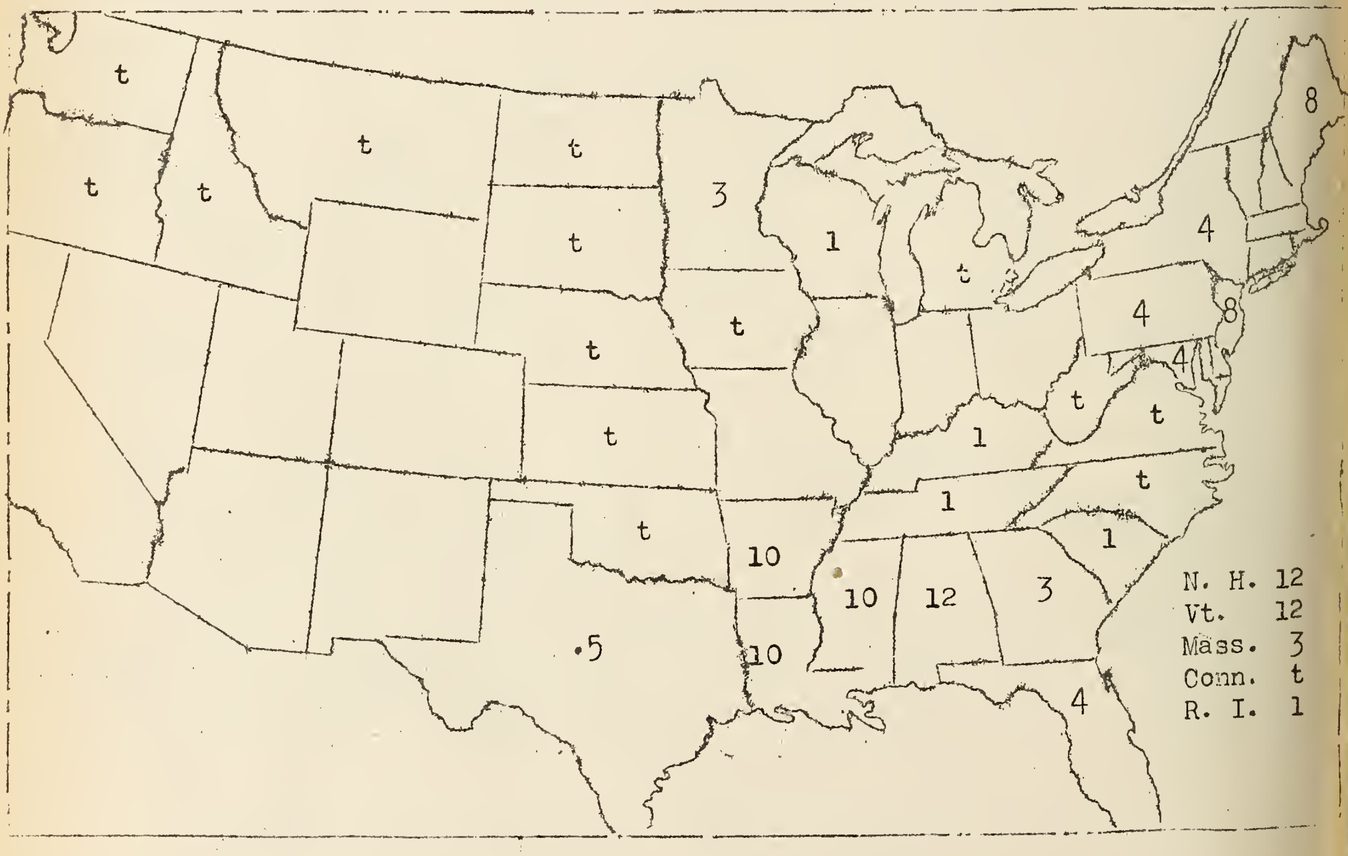

Fig. 38. Estimated percentages loss from mosaic, 1919.

In New England and also inparts of the South the disease was said to be less conspicuous and less destructive than usual. In Louisiana there was not so much of the dwarf stage as is commonly seen.

The following data on varietal susceptibility have been received:

Alabama: "Especially on Triumph. Cobblers not so bad." (Hopkins) "Wherever Triumph is grown a very high percent (25-95) of plants badly affected." (Hesler)

Arkansas: "Irish Cobbler resistant. Ten per cent of Bliss late crop affected." (Elliott)

Colorado: "Seems to be increasing on Triumphs." (McMillan)

Georgia: "Developed on more than 90% of Bliss Triumph regardless of source of seed." (McClintock)

Idaho: "Netted Gem only variety seriously affected." (Hungerford)

Iowa: "Common only on Bliss Triumph which is not grown commonly, None found on Rural New Yorker." (Melhus)

Louisiana: "Nearly 100% of Bliss Triumph affected. Scattering on other varieties." (Edgerton)

Maine: "About the usual amount of mosaic, mainly on Green Mountains and Bliss Triumph." (Shaplovalov, Aug. 8.)

Maryland: "Causing 10% loss in most late crop fields, especially on the McCormick." (Temple)

Michigan: "Common, especially in Upper Peninsula on Green Mountain and Bliss Triumph. None seen on Rurals." (Coons)

Minnesota: "Particularly on Triumph. Rare on other varieties." (Section of Plant Path.)

Mississippi: "Mosaic on Bliss Triumph in every part of state visited." (Hesler)

New Jersey: "Very abundant on American Giant. Sometimes 50% infection." (Cook).

New York: "Found in all of white sprout area and also where White Giants are grown." (Chupp)

Oregon: "Considerable in one field of California White Rose." (Barss)

Pennsylvania: "In trial plots at State College Blue Victor, McCormick, Manistee, and Extra Early Crusader showed 100% infection; Early Russett and Early Rose 95-90% infection; Norcross 15%; Peachblow 5%." (C. R. Orton)

South Carolina: "Cobblers are planted chiefly but a few reds are found and they have from 20-100% mosaic." (Seal)

Leaf roll (cause undetermined)

Leaf roll was reported to the Survey in 1919 from Maine (found scattered here and there on Irish Cobblers and even less on Green Mountains; absent or slight in many fields), Vermont (scattering, possibly 5-10% loss), Massachusetts (present in a large percentage of fields; most severe as a rule on native stock), Connecticut (inconspicuous this year), New York (common everywhere, especially where "blue sprouts" are grown), New Jersey (less than usual, not found to exceed 2% in any case), Pennsylvania (generally found throughout state averaging at least 10-25% affected plants), Maryland (prevalent), Tennessee (common, slight loss), Louisiana (loss small in most commercial fields but high in some such patches), Texas, Oklahoma, Michigan (occasional, losses slight as a rule), Wisconsin (trace), Minnesota (trace), South Dakota, Montana (frequent), Arizona (negligible in Yavapai County), Idaho (slight), and California (found in all parts of state, 8% reduction).

The disease was mentioned as occurring severely on Dibble's Russet in Connecticut, New Jersey, and Pennsylvania, and on Irish Cobbler in New Jersey. At State College, Pennsylvania, the following varieties, arranged in order of susceptibility, were found to be attacked: Seneca Beauty, Early Six Weeks, World's Wonder, Dibble's Russet, Gold Coin, Petoskey, and Rural New Yorker.

Curly dwarf (cause undetermined)

So-called curly dwarf was reported from Indiana, Iowa (severe in Early Ohio), Nebraska (slight), and Idaho (rare).

Malnutrition

Breaking down of potato plants, known as "malnutrition trouble" or "potash hunger" was noted by Shapovalov in Maine in some of the earlier planted fields where a fertilizer containing no potash was used. It was also observed by Clinton in Connecticut but there was much less than usual in that state. Local occurrences were also reported in South Carolina and Minnesota.

Anthracnose caused by Colletotrichum sp.

This apparently new disease was discovered August 1 in a garden near Vermillion, Ohio, by collaborator A. D. Selby. A few days later it was found at Wooster apparently doing considerable damage and by the end of the season it had been reported from twelve Ohio counties, most of which were located in the northern part of the state. It seemed to be most common on the early crop but abundant and widespread. Very often the fungus was associated with early blight or Fusarium wilt so that the strength of its parasitism is still open to question. Miss Freda Detmers is working on the disease.

Internal brown spot (cause undetermined).

This disease was reported from Washington and California and a similar if not the same trouble was observed by many pathologists on Long Island, New York, at the time of the Potato Conference June 24-28.

In California D. J. Milbrath reported the trouble to be very general in all sections, affecting a large percentage of the crop. Burbank was more affected than White Rose, Harvest King, or British Queen.

Borax injury caused by borax in fertilizers.

This trouble has been the subject of study and report by Schreiner, Brown, Skinner, and Shapovalov of the Bureau of Plant Industry (U. S. D. A. Department Circular 84, 1920). In Maine the injury was largely confined to Aroostook County, where a great deal of the fertilizer associated with this trouble was used. In other places, however, where injurious fertilizers were applied, the injury appeared to be about the same as in northern Maine. For full report on this subject see publication mentioned above.

Other diseases.

Southern blight caused by *Sclerotium rolfsii* Sacc. was reported from South Carolina and Louisiana. About 1% injury was reported from the latter state.

Powdery scab caused by *Spongospora subterranea* (Wallr.) Johnson was reported from Minnesota by J. J. Christensen, field assistant on potato wart survey, as follows:

> "Powdery scab was found at Two Harbors, in Lake County and at Virginia and Duluth in St. Louis County. The infections at Virginia and Two Harbors were quite light but the one at Duluth appeared to be quite severe."

According to the Section of Plant Pathology at St. Paul this is the first report of its occurrence in the state since 1916.

Violet root rot caused by *Rhizoctonia crocorum* (Pers.) D.C. was reported from Sheridan and Kimball Counties, Nebraska. This was said to be the first occurrence of the disease on potato in Nebraska.

Spindling sprout (non-parasitic) reported from New Hampshire, Pennsylvania, and New Jersey.

Soil rot (pox or pit) caused by *Cyptospora batata* Elliott occurred on white potatoes in New Jersey. The total injury to the crop was reported to be less than 1%.

Leak, probably caused by Pythium or Rhizopus, or both, was reported by D. G. Milbrath to be present, as usual, in California in the Stockton Delta region.

Stem and tuber rot caused by *Armillaria mellea* was said to be common in newly stumped land in Michigan, and was also reported from Klickitat County, Washington.

Dodder (*Cuscuta arvensis* Beyrich) was reported injuring potatoes in Walla Walla County, Washington.

Streak, cause not known, was reported from Pennsylvania (Center County; injury 5-10% in one garden; August 25); from Minnesota (one report, Itasca County); and from Idaho (quite common in southern part of state; reported from Canyon, Elmore, and Twin Falls Counties; loss estimated at .5%). In Pennsylvania the disease was observed only on the Green Mountain variety grown from Vermont seed.

Dwarfing of plants, similar to curly dwarf but with no curling of the leaves, was said to have been observed in several fields in southern Idaho, (Elmore County), The loss ranged from slight to 25% in the fields affected. The disease was apparently carried with the seed as all the fields in which it occurred were planted from the same seed lot.

Chlorosis (non-parasitic) was said to be common in southern Idaho.

Sun scald (non-parasitic) was reported from Yakima County, Washington and from Idaho where it was very severe in the Boise and Payette Valleys, causing a loss to the mid-season crop of Idaho Rurals estimated at more than 5%. In the latter state it was said to have been caused by leaving potatoes planted in light soil in the ground without irrigation when no cars could be secured.

Lightning injury was reported from Pennsylvania, Louisiana, Minnesota, and Wisconsin. In Pennsylvania, C. R. Orton reported one spot, including 125 plants killed in Erie County, August 20. In Louisiana, C. W. Edgerton reported the killing of all plants in an area 30 feet in diameter. In Minnesota, one case of a spot 15 feet in diameter was observed and in Wisconsin three instances of slight injury were noted, and reported by R. E. Vaughan.

Spray injury was reported from Connecticut, New Jersey, and Pennsylvania.

DISEASES OF TOMATO

Leaf spot caused by Septoria lycopersici Speg.

Leaf spot occurred in the greatest amounts again as usual in the group of states comprised of New Jersey, Delaware, Maryland, Virginia, West Virginia, Ohio, Indiana, Illinois, Kentucky, and Tennessee. There are indications also that parts of the Carolinas lost heavily.

It was common but not serious in most of the southern states except Florida and Louisiana where only a few occurrences were noted. In fact the report from Florida is the first received from that state since a single collection by Harter in 1910. Last year it appeared in one field at Moore Haven doing considerable damage to young plants on April 1. The occurrence of the disease in this state should be watched from year to year, in order to determine its behavior under Florida conditions.

The disease was not a factor in the Lake states, but in Iowa, Missouri, Nebraska, Kansas, Oklahoma, and Texas some loss was sustained although nothing like that in the Central Eastern group. Slight amounts of the disease are reported from Colorado, where it was noted for the first time last year, but was apparently not of any importance. In fact, the Survey has no record of its occurrence in many of these western or Pacific states, nor does it have any data to show that this leaf spot has ever been at all destructive in those regions.

This may possibly be because it is limited by natural factors, or as is perhaps more likely the case, the organism may not be sufficiently abundant to cause much damage. The fact that it was first noted in Colorado in 1918 and in Florida last year for the first time in recent years is significant. It may indicate that the disease is spreading. A glance through some of the older survey records shows reports in 1907 when leaf spot was just beginning to show up in Marion County, Illinois. Only one report of the occurrence of the disease in Washington (1913) is at hand; none from Oregon; and only two from California (1912-1917). It would seem that the disease would bear watching on the Pacific Coast.

In the region already mentioned; namely, the tri-state section, made up of New Jersey, Delaware, Maryland; and the Ohio Valley states, Septoria leaf spot is by far the most important of all tomato diseases, causing an average loss last year of about 20% of the crop.

The tri-state area, which is the most intensive and the most important tomato canning section in the country, and Virginia and West Virginia produced about two and one-half million cases of No. 3 canned tomatoes in 1919. It is estimated that this same area sustained a loss of about 24% of the crop from tomato leaf spot alone or about 1,000,000 cases off from the normal production. The following table shows losses incurred by leaf spot in the important commercial tomato canning state-groups:

Table 63. Losses caused by Septoria leaf spot of tomato in the important commercial tomato canning state-groups.

State	Commercial production canned tomatoes (cases #3)	Percent	Reduction from normal. (cases #3.)
New York Pennsylvania	514,140	3	18,472
Delaware Maryland New Jersey Virginia West Virginia	2,641,897	24	1,006,435
Ohio Indiana Illinois Michigan Minnesota Iowa	1,045,491	5.5	64,427
Colorado Washington Utah	995,119	.2	2,293
California	1,736,207	t	-
Missouri	504,534	2	11,088

Dates of first appearance according to collaborators, 1919.

April 1 .... Florida (young plants)
April 18 ... Mississippi (in seed bed)
May .... Louisiana
May .... Arkansas
May 15 ..... South Carolina
May 20 ..... Tennessee
May 29 ..... Indiana
June 8 ..... Missouri
June 10 ..... Georgia
June 20 ..... South Dakota
June 25 ..... Minnesota
July 2 ...... Virginia
July 2 ...... Oklahoma
July .... Wisconsin
August 2 .... Ohio

The only mention of varietal resistance was made by Fromme in Virginia and Elliott in Arkansas. In their states the variety Norton was said to be somewhat less susceptible than other varieties.

In no state does spraying for the control of tomato leaf spot appear to be practiced commercially to any great extent, although plenty of demonstrations have been made in a number of states where leaf spot is bad to show that on the average it greatly increases the yield. In many cases this is probably because the growers are waiting to be shown that it actually pays them to spray, and then again the exact spraying program has still to be laid before them. In Louisiana, Edgerton reported that spraying is not satisfactory. On the other hand, in Oklahoma, Bordeaux gave good control in some cases, and in North Carolina Jehle reported a great reduction of leaf spot on the plots in Avery and Mitchell Counties that he was spraying for late blight.

Fusarium wilt caused by *Fusarium lycopersici* Sacc.

Fusarium wilt is distinctly southern in its range. It caused its greatest damage in the South Atlantic and Gulf regions and in adjacent states. Further north the disease becomes less frequent, although it is of much importance in the tri-state tomato region composed of New Jersey, Delaware, and Maryland; in the Ohio Valley; and south of the Missouri River. The disease extends northward up the coast as far as Connecticut, where it occasionally occurs to a slight extent, but in the northern tiers of states the disease is practically absent in the field although occasionally destructive in greenhouses. In Florida it has been observed for several years but has not been rated as of great importance. Last spring, however, it was found by Pritchard and Clark to be serious, at least in the southern part of Dade County where they found some fields with from 75-90% infection. They made an estimate of 40-50% infected plants for the Miami and Homestead sections. It is probable, therefore, that the losses from this disease in Florida have been under-estimated in the past. In the western states its occurrence is somewhat a matter of uncertainty on account of its confusion with diseases of a similar nature such as the yellow blight of the northwest and the summer blight of California. However, a report has been received from Milbrath in California, indicating that Fusarium wilt does occur in that state and probably causes as high as 3% loss. It is also mentioned as occurring in the southern part of Colorado and in East Central Arizona, but the exact identity of the disease in these states does not seem to have been established.

This disease is the most important tomato disease of the extreme South Atlantic and Gulf states. It ranks second only to Septoria leaf spot in importance for the United States as a whole. Estimates of losses would seem to indicate that in general it was more severe in 1919 than in 1918 in spite of the fact that considerable progress was made toward control in some sections. In the Southern States tomato production would undoubtedly become much more important if it were not for this persistant soil trouble. As it is now, Florida is the only state that produces many early tomatoes for the northern markets.

Loss estimates by state and for the country as a whole have been made and are given in Plant Disease Bulletin, Supplement 12, 1920.

The dates when the disease was first noted in 1919 in various states are as follows:

March 24	Florida (just appearing in field)
March 24	Louisiana (in seed bed)
April 20	Mississippi (one young plant)
May	Louisiana (general in field)
May 15	Georgia
May 15	Tennessee
May	Arkansas
June 15	South Carolina
June 17	Indiana
July 2	Oklahoma
July 15	Missouri

Varietal resistance to this disease is rather marked and because of the fact that many states have been trying out resistant strains the following specific question was asked collaborators in connection with the request for their annual report: "What was your experience with the use of tomato seed resistant to Fusarium wilt? Give varieties used, source, and success with each." Most collaborators who had made observations along these lines kindly complied with the request and their statements are given below by states as follows:

Virginia: "Norton has been used for two seasons and has proved wilt resistant and also of good quality and a heavy bearer. Marvel, Arlington, and Columbia were also distributed this year but little information has been received on their performance." Fromme.

West Virginia: "Tomato seed resistant to wilt has been used in several locations and has given good results in several cases, but not in others." Giddings.

Tennessee: "The common variety of tomatoes known as 'Livingston's Globe' is naturally resistant to Fusarium wilt, and it is used extensively in the Humboldt section. A resistant strain selected by the Tennessee Station has been tried out on a small scale. This seed can be secured from the Botanist of the Station for trial." Essary.

North Carolina: "The Marvel, Arlington, Norton, and Columbia varieties of tomatoes were obtained from the U. S. Department of Agriculture and tested in many parts of the state. In only one place a definite report was received, at Lexington, North Carolina, and here they gave entire satisfaction, all other tomatoes dying from wilt." Jehle.

South Carolina: "Small plots with good results. Varieties used were Arlington, Marvel, Norton, and another variety, all from Mr. F. J. Pritchard."

Louisiana: "Two wilt resistant varieties of tomatoes developed at the Louisiana Station and the four government varieties tested alongside of commercial varieties. The two Louisiana varieties Norton and Marvel show more resistance than the others. None of them are really wilt resistant, but some of them show more tolerance. Of all varieties tested, the Stone is the most susceptible and produces the poorest yield of any. The use of this variety has hurt the work of the girls' tomato and canning clubs in many sections." Edgerton.

Florida: "Certain varieties of the globe type seem to be much more resistant than others." Sherbakoff.

Arkansas: "Norton, Columbia, Arlington, and Marvel secured from Washington, have been tried out on a large scale and several other varieties secured from Manns of Delaware Station on a smaller scale. One variety originated by Dr. Manns proved the most resistant under all conditions tried in a two years' test. Next to this came Norton, which was about 50% resistant in a field test where Columbia, Arlington, and Marvel were not over 15% resistant and where nonresistant varieties were a complete failure. In this test Dr. Manns' tomato was about 80% resistant. Seed of the Norton tomato was sent to a great many places over the state and reports of success when other varieties failed were received from most of them." Elliott.

Missouri: "The seeds of varieties of tomatoes resistant to Fusarium wilt put out by the United States Department of Agriculture are said to be more or less promising." Maneval.

Kansas: "The past season some of the tomato varieties resistant to Fusarium wilt have been given a rather careful test. Results show that they are very promising from the wilt resistant standpoint. In fields where the disease was so abundant that it killed commercial varieties, Columbia and the unnamed variety, according to collaborators in the state, came through without a missing plant in badly infected soil. We are going to give all the varieties a thorough test the coming year. To date they look most promising." Melchers.

Georgia: "All so-called resistant strains which we were able to obtain were tested in badly infested soils in 1919 and none proved sufficiently resistant to grow and bear throughout the summer." McClintock.

Kentucky: "A strain of New Century obtained from Durst in Illinois proved resistant when grown alongside some of the more common varieties at Henderson." Valleau.

Maryland: "Wilt is easily controlled with resistant varieties. Over 2000 persons were furnished with wilt resistant seed this year." Temple.

Ohio: "Only early maturing varieties especially susceptible." Thomas.

Early blight and nail-head spot caused by Macrosporium spp.

In the past we have considered early blight and nail-head spot as being caused by the same organism, Macrosporium solani. Because of the recent work of Rosenbaum and others, however, it appears that there is more than one organism concerned in these troubles. Hence, they are mentioned above as being caused by Macrosporium spp. They are considered together, however, as the reports do not distinguish between the various types of disease.

Nail-head spot occurs chiefly in the extreme southern states. It is far more prevalent in Florida than in any other state but reports are at hand also from Louisiana and Texas, and it is known to occur in the tri-state territory and in the District of Columbia, but is not of commercial importance. The market inspection records further indicate its occurrence in parts of California, Arizona, and Mississippi. In connection with nail-head spot there is also considerable foliage injury.

Injury to the leaves alone with no spotting of the fruit was reported from many of the states in the central-eastern part of the country as far west as Kansas. The state that reported the most trouble from this type of injury was West Virginia where 10% loss was said to have taken place. According to Giddings the disease in that state is usually subordinate to Septoria leaf spot but last year the two appeared to be of about equal importance.

Others of the states such as Massachusetts, New Jersey, Nebraska, and California report the most injury to ripe or nearly ripe fruit, attacking especially through growth cracks, sun scald spots, or other injuries.

In Delaware Rosenbaum found Macrosporium to be taking part in the collar rot trouble that was so prevalent in the state last season. In Indiana and Kansas the disease was mentioned as causing considerable trouble in greenhouses. In the former state it was epidemic in one greenhouse near Indianapolis, and also appered in the seed beds and fields causing leaf spotting and stem cankers.

Table 64. Percentage nail-head spot as shown by inspection at destination by inspectors of the Bureau of Markets, 1919.

Origin of shipment	No. of cars with nail-head spot	Average percentage of nail-head spot	Range of percentage of nail-head spot	Remarks as to seriousness of injury.
Arizona	1	6	5-8	Affected fruit showed 1-2 spots.
California	2	16	7-25	One car showed 25% fruits with 1-3 spots.
Florida	116	12	1 car 90	2-10 spots.
			9 cars 30-50	Generally 3-6 spots.
			106 cars 1-25	All stages.
Louisiana	1	90	90	5-15 spots on each tomato and spots badly run together.
Mexico	7	8	2-12	Rather badly spotted.
Mississippi	2	12	1-3	Slight spotting.
Texas	5	5	3-10	Rather badly spotted.
Unknown	2	-	-	More or less decay.

The sum total of loss from nail-head spot in Florida was great as usual. The number, size, and quality of fruit was reduced; many fruits had to be discarded at the packing houses and the tomatoes that arrived on the market were badly blemished. The above table shows the amount of nail-head spot in car shipments as found by inspectors of the Bureau of Markets. The inspections were all made between the dates of February 10 and June 18.

It will be noticed that the disease was especially common in shipments from Florida, as it was found in 116 cars. In one car, inspected June 9 at Chicago, 90% of the fruit showed from 2-10 nail-heads. The average percentage of infected fruits was 12% in the 116 cars and the average number of spots per tomato ranged from 3-6, but with some cars as many as 5-10 spots were noted.

The following table gives the markets and number of cars of Florida tomatoes with nail-head spot inspected at each city:

Table 65. Number of cars of Florida tomatoes with nail-head spot inspected at various cities, 1919.

Place where inspected	Number of cars	Place where inspected	Number of cars	Place where inspected	Number of cars
Baltimore	18	Pittsburgh	9	St. Louis	5
Chicago	18	Boston	7	New Orleans	5
Cleveland	16	Detroit	7	Buffalo	4
New York	10	Philadelphia	6	Others	11

The losses due to Macrosporium on the foliage were heavy in some states, particularly in Florida, Louisiana, Texas, and West Virginia. Figures showing the estimates of loss from this fungus are given in Plant Disease Bulletin, Supplement 12, 1920.

Dates of first appearance, 1919.

February	Florida	May 20	Tennessee
April	Louisiana	June 19	Virginia
May 12	Indiana (greenhouse)	July 28	Ohio
May 15	South Carolina	July	Wisconsin

Certain varieties in Florida are said to be less susceptible than others to early blight and nail-head spot. This is the only state mentioning any variation in susceptibility.

Spraying with Bordeaux was reported on as follows: Florida, fairly successful; Louisiana, only fair results on account of too much rain; North Carolina, usually checked by spraying; South Carolina, fair results.

Mosaic, cause undetermined.

This disease was reported from seventeen states widely scattered over the country. Within most of the states also the disease seemed to be more or less sporadic or localized. Thus, in Florida the disease was said to be especially serious about Ft. Myers and Moore Haven and in Indiana it was especially bad in the canning area. In New Jersey, Maryland, and Louisiana, however, the disease was said to be quite general. It occurred in greenhouses as well as in the field. In one large greenhouse in Ohio a severe outbreak was reported on some 4000 plants of Bonney Best.

Mosaic seems to be increasing in importance. In many localities it caused heavy losses last year. In California it was prevalent in Santa Clara County, which is one of the largest canning production centers of the state. In Florida it appeared to be localized but in sections where it was observed it was very bad indeed. According to Link and Ankeney the growers in those localities claim it has been ruining their crop during recent years. In Georgia 1-2% loss for the state was estimated. In Indiana 50% of the crop was reported injured and the disease was epidemic in the canning section of the central part of the state. In Louisiana a high percentage of the crop was reported injured. In Missouri one field of Dwarf Champion was observed by Philpott in Jasper County, where the disease was severe, and the reduction in yield from this was put at about 30%. In Pennsylvania a two acre field at East Springfield was observed by Muncie which showed at least 90% mosaic plants.

In contrast with these reports of considerable damage, the important tomato states of New Jersey, Delaware, Maryland, and Ohio report that although the disease is common it is not a very important factor in reducing the yield. Collaborators in Minnesota, Nebraska, and Arkansas also speak of it as causing only slight damage.

No varieties were mentioned as showing resistance, and no control measures were given in the various reports received.

Late blight caused by Phytophthora infestans (Mont.) De Bary.

According to the Survey records late blight of tomato is limited to the northeastern portion of the country and to the Pacific Coast. However, reports of its occurrence were received from Kansas in 1918, and from Missouri in 1919. It was noted in seven places, mostly in the greenhouse, in the latter state. As these reports have not been checked yet by specimens they cannot be considered as authentic. The disease was reported also by Stevenson from Porto Rico in 1917 where conditions during the winter months were said to be favorable for its development. No particular damage was done, however.

The accompanying maps show the range of the disease as it has been reported to the Plant Disease Survey during the last five years.

It will be noted that in the East the disease is reported most frequently along the Appalachian Range from Pennsylvania as far

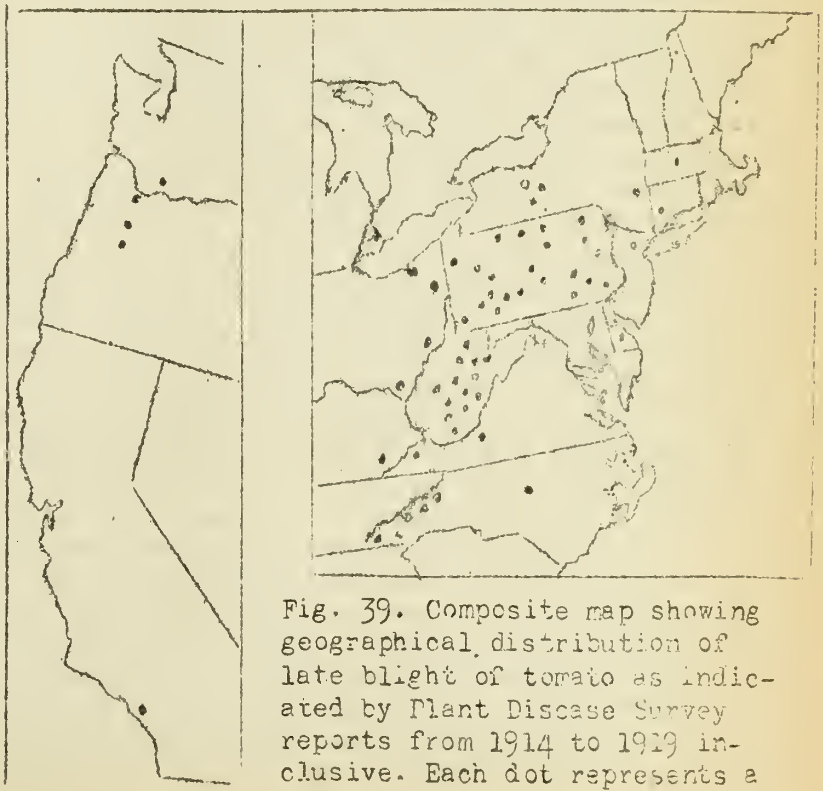

Fig. 39. Composite map showing geographical distribution of late blight of tomato as indicated by Plant Disease Survey reports from 1914 to 1919 inclusive. Each dot represents a county.

south of the Georgia border. The eastern portions of West Virginia and the western extremes of Virginia and North Carolina are in the center of the area where the greatest damage occurs.

In the West the disease has frequently been reported from the northern portion of the Willamette Valley and across the border in Klickitat County, Washington. It will also be recalled that R. E. Smith (Tomato Diseases in California, California Experiment Station, Bulletin 175: 1-16, 1906) reported the disease as causing an epidemic in November and December of 1905 on the winter tomato crop of southern California, particularly about La Habra in Orange County. Doubtless the disease has been present in this section annually since 1905 but no records are at hand to certify as to this. In 1919 no reports of the disease were received from the Pacific Coast States although it probably occurred there.

A study of the reasons for the limited range of this Phytophthora on tomatoes would seem to be a fruitful field for investigation. The preference of the fungus for the higher altitudes in the east, coupled with the fact that in Southern California and Porto Rico it is only active during the winter, would lead to the supposition that temperature is a very important factor. Of course, an abundance of atmospheric moisture is needed and the stage of the crop also has to be taken into consideration.

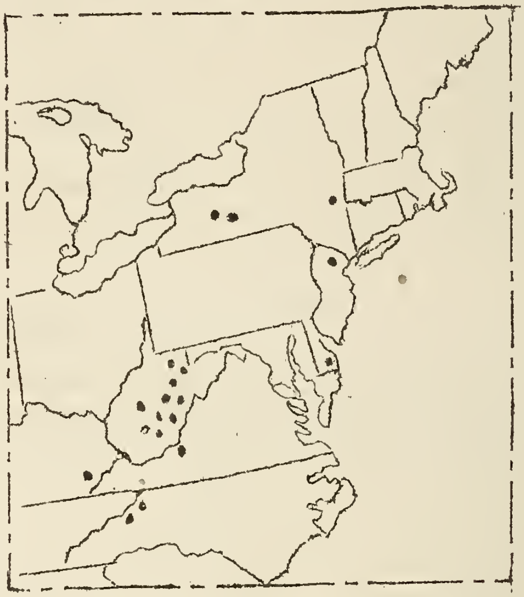

Fig. 40. Geographical distribution of late blight of tomato in 1919 according to maps prepared by collaborators. Each dot represents occurrence within a single county.

The total loss from this disease is not great as the damage occurs only in portions of a few states. West Virginia was most affected with about 20% of the crop more or less injured and 8% loss. In that state the season was very moist, with the result that the blight was unusually prevalent. According to Giddings many gardens in the southern and central part of the state matured absolutely no tomatoes on account of the trouble. In Virginia the disease was apparently more or less localized in the vicinity of Blacksburg. Regarding it Fromme says, "Very severe at Blacksburg, causing vine death in some cases and almost complete loss of early settings of fruit during a period of excessive rainfall. With the return of dry weather in August the disease largely disappeared and some fruit matured."

In North Carolina the disease was under close observation by Jehle in Avery and Mitchell Counties, where he had demonstration plots to show control by spraying. The checks in these plots and other unsprayed fields in the locality were all more or less severely affected. Even when the vines were only slightly diseased practically all the fruit on them rotted as a result of Phytophthora infection. Jehle estimated a state loss of 2% from late blight. In the other states from which the disease was reported it did not appear to be of particular importance, as the injury was local and for the most part slight.

Table 66. Approximate dates of first appearance of late blight as given by collaborators, 1916-1919.

State	1916	1917	1918	1919
New York	--	September 24	--	--
Pennsylvania	--	October	--	--
Virginia	August 1	--	July 16	July 1
West Virginia	--	Early August	July 28	--
North Carolina	--	--	--	July 15
Kentucky	--	--	--	July 7
Missouri	--	--	--	July 11

Further light is thrown on the relation of Phytophthora on the two hosts, tomato and potato, by the observation reported from New York by Chupp in 1919; namely, that in Cayuga and Tompkins Counties the disease was observed as a fruit rot on tomatoes growing adjacent to blighted potatoes.

Spraying with Bordeaux 5-5-50 plus 3 lbs. of resin fish-oil soap was reported as giving good results in West Virginia and North Carolina. In the latter state Jehle reported that the difference between the sprayed and unsprayed plots in his demonstrations was very marked. He used both the plain Bordeaux and the resin fish-oil soap Bordeaux.

Yellow blight caused by Fusarium spp.

Yellow blight was reported from Washington, Oregon, Idaho, California, Nevada, and New Mexico. The trouble in Washington is referred to by Heald as being due to Rhizoctonia but in the other states collaborators speak of it as being caused by the Fusarium oxysporum and F. orthoceras combination as worked out by Humphrey.

This disease is the most serious tomato trouble of the northwest. Annually it caused much damage and in 1919 the loss appears to have been considerably above the average. In Washington it was said to be more severe than for a number of seasons. Cases were reported by Heald where tomatoes following potatoes showed 95% injury. In Oregon at least 25% loss was sustained in the principal tomato section. In Idaho it was very common and destructive throughout the state, killing as high as 75% of the plants in some commercial fields. In Nevada, where the disease was severe in Chruchill, Washoe, and Lyon Counties, 10% loss was estimated; and in New Mexico 25-100% loss was reported.

Two interesting reports of the yellow blight situation, as it was last year, have been received from Idaho and Oregon. C. W. Hungerford has furnished the following:

"Observations on tomato yellow blight in Idaho in 1919."

> "Tomato blight has been reported from every section of the state and seems to have been unusually severe this year. Commercial growers in the Lewiston district in Northern Idaho and those in the Twin Falls district of Southern Idaho unite in saying that the disease has been as destructive this year as it has ever been. A loss of 50% of the entire tomato crop of the state is a conservative estimate.

"Weather conditions seemed to be very favorable to the disease. The season was exceedingly hot and dry. In nearly all of the irrigated districts there was a shortage of water during at least part of the growing season.

"Letters of inquiry began coming in about July 15 and the disease was noted at Moscow about that time. Fields of tomatoes were inspected at Lewiston, Idaho, on July 29 when the first tomatoes were just beginning to ripen. In some of these fields 75% of the plants had already been killed by the blight at that time. These same fields were again inspected September 10 and in some of them 90% of the plants were dead. Many plants which appeared perfectly healthy at the first inspection were dead by the second. It has been noted that plants in the field may die of the disease any time from when they are about eight inches high until frost kills them. In the greenhouse the disease may take seedlings as they emerge from the ground.

"The disease has been noted on new sage brush land which had never been cropped before and on nearly every kind of soil. It was noted in plants which had never been transplanted, the seed having been planted in the ground out of doors in the spring. In many cases it was noted that tomatoes grown on very rich soil and well cared for were injured by blight much less than those on poor soil and those having poor care.

"Some of the varieties of tomatoes grown on the College Farm seemed to be quite resistant to the disease."

From Oregon the following note by M. B. McKay has been received:

"Very prevalent in The Dalles section, the important tomato region of the state, blighting about 50% of the plants and causing not less than 25% loss. Plants that are blighted late produce a part of a crop. All varieties are affected. The four varieties of tomatoes, Arlington, Columbia, Marvel, and Norton, sent out by the U. S. Department of Agriculture as resistant to wilt in the East, are all apparently about equally and extensively susceptible to the Western Yellow Blight. Tomatoes planted on land which had never before grown tomatoes blighted badly. This infection, of course, may or may not have come from the seed bed. One patch from which an excellent crop of tomatoes was being harvested was observed on land which was said to have grown tomatoes consecutively for 25 years. Ordinary commercial seed was being used. Tomatoes in another piece of land not more than 100 yards distant were blighting badly."

Bacterial wilt caused by *Bacterium solanacearum* E.F.S.

This distinctly southern disease, as usual, occurred most frequently in the Atlantic States south of North Carolina and those bordering on the Gulf. It was said to be common in Arkansas and of infrequent occurrence in Delaware, Maryland, Virginia, West Virginia, Kentucky, Tennessee, Missouri, and Texas; and it was even reported as far north as Pennsylvania, Ohio, Nebraska, and Colorado. These latter states represent the approximate northern limits of the wilt although it has been reported up the Atlantic coast as far north as Massachusetts.

Bacterial wilt cannot be considered of great economic importance when compared with diseases like Septoria leaf spot or Fusarium wilt. For the country as a whole it is a minor disease, but for the tomato industry of the southern states it is a serious trouble. It probably ranks next to Fusarium wilt in importance in that part of the country. Judging from the loss estimates at hand Louisiana probably suffered the most of any state, as 10% loss is estimated, while the other South Atlantic and Gulf states averaged about 5%.

The dates when the disease was first reported are as follows:

May 1	Florida	June	Arkansas
May 15	South Carolina	August 1	Tennessee
June	Louisiana		

No varieties were mentioned as showing any resistance and little was given on control except that crop rotation was mentioned as beneficial by some collaborators.

Blossom-end rot (non-parasitic)

Blossom-end rot was reported from most states with the exception of those in the Rocky Mountain section and part of the Great Plains area.

It can be said quite safely that in general it was less abundant than in 1918, when it was unusually severe. States in the northern part of the country, especially Vermont, New York, and Wisconsin reported it as less troublesome than usual. It was mentioned by Gardner in Indiana and Milbrath in California as worst on the first fruit and that later settings were fairly free. In the early tomato section of San Diego County and the San Joaquin Valley, California, the disease was particularly destructive. The Southern States seemed to suffer most heavily as is shown by the following table:

Table 67. Injury and losses from blossom-end rot as reported by collaborators in 1919.

State	Percent fruit injury	Percent loss	State	Percent fruit injury	Percent loss
Vermont	1-5	1-5	Arkansas	5	-
South Carolina	10	1	Tennessee	10	-
Georgia	5-100	30	Wisconsin	t	t
Florida	-	5	California	-	10
Mississippi	-	20-30	Indiana	5	2
Texas	-	3			

In New York, in the Chautauqua and Niagara districts, some fields showed from 5 to 20% injury and one field was found with 65% of the fruit affected. In Mississippi W. S. Fields found the following condition:

> "At Crystal Springs and Hazelhurst the crop suffered heavily this season through blossom-end rot and cat face. At least 40% of the fruit on the vines is affected with either or both of these. One of the farmers told me that he would be willing to give $1000 to find a way to stop blossom-end rot."

As this disease is clearly evident in the field it is not especially common in shipments of tomatoes. Market inspectors found it in some consignments, however. One car from Florida showed 2% in early stages; two cars from Mexico averaged 8%; and one car from Mississippi had 9%.

The dates of earliest recorded appearance were as follows:

May	Florida	June 14	Washington
May 10	Tennessee	June 18	Indiana
May 15	Mississippi	July	Oklahoma
June 1	Georgia	July	Wisconsin
June 1	South Carolina	August 20	Vermont

No resistant varieties or control measures were mentioned.

Buckeye rot caused by *Phytophthora terrestria* Sherb.

This rot was found in Florida and Porto Rico during 1919 and two new and interesting occurrences were reported during the year, one by M. W. Gardner, Indiana, where it was found in a greenhouse near Indianapolis; and the other by J. L. Weimer, who observed the disease occurring naturally on plants growing in the department experimental field plots at Arlington Farms, Virginia. The disease was also reported in shipments of tomatoes from Mexico and Tennessee. Since these latter are new records, however, and as they have not been substantiated by findings in the field, they should be considered only as possible rather than actual occurrences.

Judging from the reports at hand the disease was worse than usual in Southern Florida, probably because of the heavy rains that occurred just prior to harvest. The crop was greatly damaged by the flood itself and, in addition, the water greatly facilitated the dissemination of the organism. Regarding the occurrences and losses from the disease in the Miami section Rosenbaum says:

> "All fields are showing an exceptionally heavy infection with ground rot, *Phytophthora terrestria*. One of the fields where we did some work before the rains and which had very little or no Phytophthora is now showing by actual count more than 66% infected fruit. One grower who had hired special labor for picking fruit on the day following rain, and immediately packed more than 500 crates, was compelled to repack all these on account of the development of Phytophthora rot. Less than one-third of these crates were saved. * * * Shipping work last season proved that Phytophthora spread with great rapidity in transit, a single fruit in a basket likely to involve a large number of fruit in the same basket before reaching market. Market men will likely meet a lot of this trouble in the shipments."

The disease was found in 10 carloads of Florida tomatoes inspected in northern markets in amounts averaging 7% affected fruit.

Staking plants in the field and holding fruit for a few days before packing were beneficial according to C. D. Sherbakoff in Florida.

Phoma rot caused by *Phoma destructiva* Plowr.

This disease was reported during 1919 as occurring in the field in

Florida, California, Oklahoma, Ohio, and New York. Reports of its occurrence in shipments of tomatoes said to have originated in the additional states of New Jersey, Tennessee, Mississippi, Louisiana, Arizona, were received from market inspectors, and consignments from Mexico, Cuba and the Bahama Islands were badly affected. In other years this disease has been reported to the Survey from the following additional states: Delaware, Maryland, South Carolina, Porto Rico, Iowa, and Kansas. It will be seen then that the disease has a rather wide range although destructive occurrences seem to be confined to the South, especially Florida and to places like Cuba, Bahama Islands, and Mexico.

In 1919 Florida and California were most affected. The occurrences in other and more northern states were localized for the most part in gardens and caused little loss.

The accompanying table gives the amounts of Phoma rot found in shipments of tomatoes by market inspectors. It will be noted that it was quite frequent in cars from Florida and California.

Table 68. Percentages of fruit affected with Phoma, as shown by inspection at destination by inspectors of the Bureau of Markets, 1919.

Origin of shipments	No. of cars with rot	Average percentage of rot	Range of percentage of Phoma rot		Remarks as to seriousness of decay.
			No. cars	Percent	
Arizona	1	18	1	10-25	Scattered throughout load.
California	42	27	3	35-40	Bad decay.
			17	1-20	
			13	50-100	Associated with other decays, mostly Rhizopus rot.
			9	2-33	
Cuba	4	18	4	2-32	Associated with Rhizopus rot.
Florida	168	13	4	56-100	Advanced stages of decay.
			15	29-50	Associated with Rhizopus and other decays in some cars.
			149	1-25	
Louisiana	3	18	3	2-20	Some soil rot in one car.
Mexico	22	9	22	2-22	Soil rot, Rhizopus, and other decays also present.
Mississippi	2	16	2	2-30	
New Jersey	1	25	1	25-30	Sun scald and Phoma rot.
Tennessee	5	8	5	1-17	Associated with Rhizopus.
Texas	14	8	14	2-25	Soil and Rhizopus rots also present.
Unknown	2	11	2	9-13	Rhizopus and soil rot also present.

In the New Orleans market it was observed that reconditioning of many Cuban tomatoes was necessary on account of Phoma rot and that in many cases this resulted in a discard of 25-50% of the fruit.

Regarding the condition of tomatoes received at New York from the Bahama Islands F. C. Meier writes as follows in the Cotton and Truck News Notes of March, 22, 1919.

> "One New York firm continues to receive large shipments of tomatoes from the Bahama Islands, chiefly from the Island of Eluthera. They have planned for about 40,000 crates this season from their plantings, but it is probable that acutal receipts will not reach this mark. Although

> numerous lots have been examined from time to time, Phoma rot and Rhizopus rot seem to have been the only important sources of loss to date. On these shipments Phoma rot alone is causing injury or destruction of approximately 10-40% of stock received."

Soil rot caused by Rhizoctonia sp.

Rhizoctonia, causing a rotting of the fruit or a damping off of seedlings, was reported from Ohio, Florida, Louisiana, and California. Market inspectors found it in cars of tomatoes shipped from Tennessee, Florida, Mississippi, Louisiana, Texas, Arizona, California, Mexico, and Cuba. In these shipments it was usually associated with other types of decay such as those caused by Fusarium, Rhizopus, and Phoma.

The stem rot which was prevalent in southern New Jersey in 1919 was due to Rhizoctonia, attacking the stems at the surface of the ground according to M. T. Cook. The disease evidently originated in the seed bed. The same condition was also found on cabbages in New Jersey.

Collar rot (cause undetermined).

A collar rot of uncertain cause was very prevalent and destructive in southern New Jersey, Delaware, and Maryland. This disease probably played a considerable part in the falling off of tomato production in that area last year. The trouble has been noticed in Delaware for a number of years but never in such a severe form as in 1919. Manns and LeCato in Delaware think it is of bacterial nature. Cook in New Jersey states that the trouble in the southern part of that state last year was due to Rhizoctonia, while Rosenbaum attributed the Delaware disease to Macrosporium solani.

The disease seemed to originate in the seed bed, attacking the plants near the ground level, and causing black cankers. This was carried into the field where the cankers developed further. Temple in Maryland gives the following concerning symptoms:

> "Diseased plants in the field undergo in some cases a lingering death and in other cases they may recover where the plants were set deep enough so that they can send out roots from above the diseased part. The affected portion of the stem is rarely more than two inches in length."

The loss from this disease in Delaware was extremely heavy, being conservatively placed at 25%. Some fields were a complete failure and had to be plowed up. Many farmers in that state planted as high as 80-90% affected seedlings with the result that the stand was cut 20-30% or more.

Tomatoes grown consecutively on the same seed bed showed a much greater infection than those grown on beds properly rotated, according to Manns and LeCato. The cannery run seed also showed greater amounts of disease than northern commercial seed.

Leaf mold caused by Cladosporium fulvum Cke.

Leaf mold was reported, for the most part in greenhouses, from Massachusetts, Connecticut, New York, South Carolina, Ohio, Indiana, Michigan, Missouri, Kansas and Washington. Outbreaks in the field were also noted in Florida and Indiana.

Root knot caused by *Heterodera radicicola* (Greef.) Müll.

Nematode injury was common on this susceptible crop in the South. It was reported, especially in the sandy soils, from South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, Missouri, California, and Washington. Occurrences in the greenhouse were noted in Ohio and Indiana.

Other diseases.

Damping off, caused by *Pythium* sp. was reported on seedlings in Washington.

Rhizopus rot, caused by *Rhizopus* sp., was common in tomato shipments from southern states. Because of the frequent association of this rot with other decays of a similar nature, but caused by other organisms, it is not easy for inspectors to make an accurate diagnosis, to say nothing of being able to estimate the amount of injury from the disease.

Rot, caused by *Diplodia* sp., was reported by F. C. Meier as follows:

> "On two different occasions Bahama tomatoes were found to be decaying as a result of infection of *Diplodia* sp. This type of decay progresses rapidly and is very destructive, soon converting the tomato into a blackened mummy with the causal organism fruiting on the exterior. Dr. Rosenbaum isolated a Diplodia from tomato last spring from the vine. This being the case it is possible that the fungus will be found on Florida fruit at destination points. The organism seems to be identical with that causing rot of melon and citrus fruits."

Sclerotium blight, caused by *Sclerotium rolfsii* Sacc., was reported from Louisiana and Alabama.

Sun scald, produced by exposure to hot sun, was reported as common on fruit in New Jersey, Florida, Ohio, Indiana, California, and Washington. It was particularly bad on plants that were defoliated by Septoria leaf spot.

Anthracnose, caused by *Colletotrichum phomoides* (Sacc.) Chester, was reported as occurring sparingly in Delaware, Ohio, Indiana, and Missouri. In New Jersey it was said to be abundant and the cause of heavy losses.

Winter blight, bacterial, was reported from Pennsylvania. J. H. Muncie observed typical specimens at Girard in Erie County in early August.

Summer blight, cause unknown, was said by D. J. Milbrath to be common in all sections of California, causing about 3% loss of the vines in the state.

Grand Rapids disease, caused by *Aplanobacter michiganensis* E. F. S., was found by Muncie near Girard, Pennsylvania. At least 200 plants were badly affected in one ten-acre field.

Brown ring spot, (cause undetermined) was found to be abundant on both green and ripe fruit in a car of Mexican tomatoes inspected by Milbrath in California.

Yellowing, probably due to malnutrition, was noted by R. A. Jehle in North Carolina. The grower said it was worse early in the season but a good many plants outgrew it.

White spot of the fruit, (cause undetermined) was noted by Milbrath in California on a few plants of early varieties. One plant produced 90% spotted fruit. The same trouble was noted by him in a carload of Mexican tomatoes.

Streak (cause undetermined) was reported from Washington, April 4.

Bacterial rots of fruit were reported from New York (in greenhouse) and Delaware (uncommon, 1-2%).

Phytophthora wilt, caused by an undetermined Phytophthora, was reported by Chupp from New York where it did serious damage in certain greenhouses at Ithaca.

Oedema, (non-parasitic), was reported from Washington where it was noted April 10.

Failure to set was one of the chief troubles in the eastern tomato section last year. A peculiar combination of weather conditions at blossoming time was said to be responsible. Complaints of blossom-drop were received from California, where it was said to be general in the early spring fields; from Washington, and from Florida. In the southwestern part of the latter state the dropping of the crown-hand blossoms seemed to be almost universal.

Tip burn, aggravated by dry weather in July, was reported general on the older leaves in Indiana August 15,

Cat face (non-parasitic) was reported as common on certain varieties in Indiana and as very prevalent in Mississippi. From the latter state, Fields reported that the Crystal Spring and Hazelhurst crops suffered heavily. Forty per cent of the fruit in many of the fields in those sections showed the trouble.

In the markets, the food products inspectors found the defect in cars from California (4 cars), Florida (1 car), Missouri (2 cars), New Jersey (3 cars), and Tennessee (7 cars). The average percentage of affected fruit in all these cars was 15%.

Lightning injury cases were reported by Manns and LeCato from Delaware as follows:

> "A very disastrous effect of lightning was observed two miles south of Dover. The rows were about 400 yards long, the wires were not grounded. The lightning struck two rows injuring or killing nearly all of the plants, skipped two rows and hit the fifth, killing practically all of the plants.'
>
> Another, and somewhat similar case, was observed a few miles away."

Growth cracks were common in Vermont according to Lutman, injuring almost 25% of the crop about Burlington and probably causing 5-10% loss. Rapid growth in September, following retarded development in August, is given as the cause. The same trouble was very prevalent in Indiana where it probably injured more fruit than any other condition. Five per cent was estimated by Gardner. This cracking of fruit is common almost everywhere tomatoes are grown for canneries.

Rain injury caused by excessive wet weather proved a calamity to the farmers in Dade County, Florida. According to Rosenbaum the Florida East Coast Growers Association estimated that the East Coast tomato section lost about 60% of its crop from this and attendant injuries. Some growers lost their entire crop. In the Homestead and Redlands districts, the injury was not nearly so great but Peters and Larkin were in the center of the affected region.

DISEASES OF SWEET POTATO

Stem rot cause *Fusarium batatis* Woll. and *F. hyperoxysporum* Woll.

In 1919 stem rot was reported from practically all of the states that are important in sweet potato production. Occurrences were reported from the following states: New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Tennessee, Florida, Alabama, Mississippi, Louisiana, Texas, Oklahoma, Arkansas, Missouri, Kansas, and California.

In the southern tier of states the disease was not mentioned as being especially bad. In most cases it was localized. In Louisiana, however, it was reported as being common and as slowly spreading over the state and thus becoming of increasing importance annually. In the northern sweet potato states, particularly the northeast section, the loss was severe. In New Jersey stem rot was abundant and the cause of heavy losses. In Delaware the disease was said to be on the increase and many fields with as high as 60% of affected plants were reported. On the eastern shore in Maryland the disease was general, causing as much as 50% loss in a few cases. In North Carolina, Arkansas, and Kansas the disease occurred in practically every sweet potato section and in some areas in each state it was severe.

More complete data as to loss from this disease in 1919 will be found in Plant Disease Bulletin Supplement 12, 1920.

The dates when stem rot was first noticed by collaborators are as follows:

March 15	Louisiana	June 26	Mississippi
April 10	Florida	July	Arkansas
June 1	Tennessee	July 11	Oklahoma

Foot rot caused by *Plenodomus destruens* Harter.

The only reports of this disease received from collaborators in 1919 were from Alabama, where the disease seemed to be causing slight losses locally, and from Oklahoma where a few occurrences were noted.

Black rot caused by *Sphaeronema fimbriatum* (E. & H.) Sacc.

Black rot occurred widely, as usual, in practically all of the sweet potato states and was reported to the Plant Disease Survey from most of them. State reports indicate that the disease was common and generally distributed throughout the sweet potato sections. It was mentioned by many of the collaborators as being prevalent on slips growing in the seed beds early in the season.

The losses incurred by black rot were large, as it took its toll both in the field and in storage. Undoubtedly, this disease was responsible for greater losses than any other single trouble. Reduction in yield in percentages and bushels by states are given in Plant Disease Bulletin, Supplement 12, 1920.

The following table shows the percentages of decay due to black rot in carloads of sweet potatoes shipped from various states, as reported by inspectors of the Bureau of Markets.

Table 69. Amounts of blackrot in shipments of sweet potatoes as determined by food products inspectors of the Bureau of Markets, 1919.

Origin of shipment	No. of cars with decay	Average percentage of decay	Range of percentage of decay	Remarks as to seriousness of decay.
Arkansas	1	5	5	One or more large spots on affected tubers.
Delaware	3	4	1-7	Two or more spots.
Georgia	2	8	6-10	Affected stock in one car worthless.
Kentucky	1	22	20-25	Associated with soft rot.
Louisiana	1	7	7	Bad.
Maryland	1	2	2	Slight.
New Jersey	1	1	1	Slight.
North Carolina	3	4	2-5	Estimate includes some slimy soft rot
Oklahoma	1	3	3	Slight.
Texas	1	30	30	Two-thirds was bad decay, balance slight.
Virginia	8	17	5-30	Rhizopus included in estimates for nearly every car.

Total number of cars with decay - 23. Total number of cars inspected - 241.

The following dates when the disease was first noted are given by collaborators:

April 15 (in seed bed).. Alabama
May 1 (in seed bed)..... Scuth Carolina
May 17 (in seed bed).... Oklahoma
May 19 (in seed bed).... Mississippi

May..................Louisiana
August 15 (in field)..Tennessee
September (in field)..Arkansas
October (in field)....Georgia

Soil rot caused by Cystospora batata Elliott.

Soil rot is limited in distribution. In 1919 it was reported from New Jersey, Delaware, Texas, and Arkansas. In New Jersey it was occasionally found; and in Delaware it was very severe in spots, sometimes injuring 10-80% of the plants. The average percentage of crop injury in Delaware is placed by T. F. Manns at 4%. In Texas the disease was prevalent, causing a loss of from 2-4% of the crop according to J. J. Taubenhaus. In Arkansas only a trace was reported, occurrences being noted in Jefferson, Sebastian, Crawford, and Washington Counties.

Scurf caused by Monilochaetes infuscans E. and E.

Scurf was reported as very common in New Jersey, Delaware, South Carolina, Georgia, Alabama, Arkansas. Missouri, New Mexico, and California, and was found in carload lots of potatoes shipped from the additional states of North Carolina, Tennessee, and Mississippi. In Delaware 10% of injury to the crop as a whole was reported: in South Carolina 20-25% injury; in Arkansas 10%; and in New Mexico 50%. The losses, however, were not very great although the market grade was considerably lower in some cases and as a rule affected potatoes did not keep so well in storage.

The percentages of potatoes affected with scurf found by market inspectors are shown in the accompanying table.

Table 70. Amount of scurf as determined by inspection of carloads of sweet potatoes by inspectors of the Bureau of Markets, 1919.

Origin of shipment	No. of cars with scurf	Average percentage of scurf	Range of percentage of scurf	Remarks as to seriousness of decay.
Alabama	1	8	8	Bad scurf.
Arkansas	1	17	15-20	
Delaware	4	11	5-17	Heavy spotting covering one-third of surface of tubers.
Georgia	1	50	50	Badly discolored.
Mississippi	1	80	80	Scurf covered one-fourth to three-fourths of affected potatoes.
New Jersey	2	19	15-25	Ranging from small spots to spots covering one-third to two-thirds of surface.
North Carolina	3	23	20-25	Badly spotted.
Tennessee	1	20	20	Covering one-eighth to three-fourths surface of affected potatoes.

Total number of cars with decay - 14. Total number of cars inspected - 241.

Soft rot caused by Rhizopus nigricans Ehr.

This was one of the most common and destructive storage rots of sweet potatoes affecting the crop in storage and in transit and in a few cases it was noticed injuring plants in the seed bed. It occurred widely where sweet potatoes are grown and it was probably the most common decay encountered by the inspectors of the Bureau of Markets when examining shipments of potatoes at destination. Table 71 gives the results of car inspection during the calendar year 1919.

Other diseases.

White rust caused by Albugo ipomoeae panduranae Farl. was reported from Delaware, Alabama, South Carolina, and Tennessee. It also doubtless occurred in many other sections. The damage done was not great but in Alabama several reports of rather heavy infestation were received. It was said to be severe on Nancy Hall in several counties of Northern Alabama.

Dry rot caused by Diaporthe batatatis (E. & H.) H. & F. One report of this disease was received from Lincoln Parish, Louisiana.

Root rot caused by *Ozonium omnivorum* Shear was reported as prevalent in Texas as usual.

Leaf spot caused by *Phyllosticta batatas* E. & M. was reported from Alabama (considerable), Ohio (less), South Carolina (common).

Leaf spot caused by *Septoria bataticola* Taub. was reported as common in South Carolina.

Java black rot caused by *Diplodia tubericola* (E. & E.) Taub. was reported from Florida where the crop was injured locally. The loss in these local cases was rather large according to C. D. Sherbakoff.

Root knot caused by *Heterodera radicicola* (Greef.) Müll. was a common injury as usual and was reported from South Carolina (common); Arkansas (general, 5% injury); Missouri (severe in greenhouses and cold frames); and California.

Southern blight caused by *Sclerotium rolfsii* Sacc. was reported from Alabama but not serious in that state.

Table 71. Amounts of sweet potato soft rot caused by *Rhizopus nigricans* as determined by food products inspectors of the Bureau of Markets, 1919.

Origin of shipment	No. of cars with decay	Average percentage of deacy	Range of percentage of decay: No. cars	Range of percentage of decay: Percent	Remarks as to seriousness of decay.
Alabama	13	15	1	60	Some complete.
			12	1-30	Considerable, some slight.
Arkansas	27	14	1	80	All stages.
			5	23-33	Some bad.
			21	2-18	Some bad, mostly slight.
California	5	27	2	32-50	All stages.
			3	12-25	All stages.
Colorado	2	22	-	20-25	
Delaware	5	21	2	30-50	All stages.
			3	5-10	Some bad.
Florida	2	18	-	15-21	Mostly bad.
Georgia	6	13	-	2-19	Mostly complete.
Kentucky	2	27	1	46	Bad.
			1	8	Slight.
Louisiana	9	13	-	2-28	Some bad.
Maryland	4	13	1	45	
			3	2	Slight.
Minnesota	1	2	-	2	Slight.
Mississippi	2	24	-	15-32	All stages.
New Jersey	5	14	1	55	All stages.
			4	1-6	Mostly slight.
North Carolina	26	12	-	2-30	Considerable complete, some slight.
Ohio	1	10	-	10	
Oklahoma	1	22	-	15-25	Bad.
Pennsylvania	1	11	-	10-12	
Tennessee	13	9	-	2-28	All stages, mostly slight.
Virginia	20	8	-	1-25	Some complete, mostly slight.

Total number of cars with decay - 145. Total number of cars inspected - 241.

Charcoal rot caused by *Sclerotium bataticola* Taub. - reported from Delaware by T. F. Manns as being common in storage houses, sometimes injuring from 1-10% of the potatoes.

Mosaic, cause undetermined, was found in several scattered districts of Arkansas.

Curly leaf, probably caused by unfavorable soil conditions, was reported as occurring locally in Florida.

Storage rot, caused by various organisms, as a group brought about the heaviest losses to the sweet potato crop. Of these rots black rot, soft rot, and others have been reported above but a good many other organisms were also concerned in the work of destruction.

DISEASES OF BEAN

Bacterial blight caused by *Bacterium phaseoli* E. F. S.

In 1919 bacterial blight probably occurred in all of the states east of Central Nebraska. West of this it was not reported from any state except Colorado where there was very little this year as compared with 1918, when the disease was epiphytotic in the bean growing sections of that state.

Losses occurred in several ways. The injury to the leaves was said to be very marked in Michigan and Pennsylvania. Less damage than usual to the pods was reported from the latter state. Considerable trouble was experienced in Michigan from infections of the nodes with subsequent breaking over of stems. Some fields in that state showed as high as 20% loss from nodal infections.

The losses as a whole were probably somewhat less than in 1918. Estimates of loss in percentages and in bushels are given in Plant Disease Bulletin, Supplement 12, 1920. For convenience the following percentage loss estimates, for states where one or more percentage reduction in yield took place are given.

Table 72. Estimates of loss from bacterial blight of bean in states where one per cent or more reduction in yield took place, 1919.

State	Percent loss	State	Percent loss	State	Percent loss
New York	5	Mississippi	5	Tennessee	5
New Jersey	1	Louisiana	8	Michigan	3
Pennsylvania	5	Texas	3	Wisconsin	4
North Carolina	2	Oklahoma	1	Minnesota	2
South Carolina	3	Arkansas	1	South Dakota	1

The dates when the disease was first observed on bean plants were given by collaborators as follows:

April.....Louisiana
May.......Arkansas
June 1....South Carolina
June 18.....Oklahoma
June 26.....Minnesota
July........Wisconsin
July 7.....Indiana
July 23....Ohio
August 9...Pennsylvania

In Massachusetts and New Jersey the disease was reported as being rather common early in the season, but negligible later on.

Anthracnose caused by Colletotrichum lindemuthianum (Sacc. & Magn.) Br. & Cav.

Anthracnose occurred in, and was reported from, practically all states in the eastern half of the country. It was also of slight occurrence in Arizona. It is rather significant that none was found in Colorado although it was especially looked for, nor was it reported from any of the other western states.

The disease may be said to have been considerably less abundant than usual. This was particularly true in the northeastern and eastern parts of the country. Thus, in Vermont it was said to be scarcer than for several years past, and from Maine, New Hampshire, Massachusetts, Connecticut, New York, Pennsylvania, and New Jersey, similar statements were received. In the southern states where green beans are raised for early markets it seemed to be fully as abundant as usual. In Texas it was very prevalent and affected about 20% of the early snap beans.

In the important bean states of New York, Michigan, and Colorado the disease did not greatly influence the yield of the crop.

Losses of dry and snap beans in percentages and in bushels by states will be found in Plant Disease Bulletin Supplement 12, 1920. The tentative percentage loss estimates, for states where more than 1% reduction in yield occurred, are as follows:

Table 73. Estimates of loss from anthracnose of bean in states where one per cent or more reduction in yield took place, 1919.

State	Percent loss	State	Percent loss	State	Percent loss
Maine	8	Florida	1	South Dakota	5
New Hampshire	3	Mississippi	7	Pennsylvania	5
Vermont	4	Louisiana	2	West Virginia	5
New York	2	Texas	5	Connecticut	2
Virginia	3	Arkansas	2	North Carolina	2
Tennessee	5	Ohio	7	Minnesota	2
South Carolina	1				

Anthracnose was found in carload lots of green beans shipped from trucking centers to city markets. Table 74 gives an idea of the general prevalence of the disease in some of these shipments.

In New England and New York the dry and hot weather was said to be responsible for the small amount of anthracnose. In Wisconsin rainy weather in June favored the disease somewhat at the start, but the dry July checked its spread. In Kansas the weather was said to be favorable for the disease but in spite of that there was very little of it.

The dates when the disease was first noticed on bean plants are given by collaborators as follows:

April 15...Florida
May........Louisiana
May........Mississippi
June.......Wisconsin
June.....South Carolina
June 9...Minnesota
June 23..Pennsylvania
June 26..Ohio
July 1.....New Hampshire
July 25....Georgia
August 2...Tennessee

Very little on varietal susceptibility was reported by collaborators, although Orton in Pennsylvania reported the disease as particularly destructive on Yellow Eye.

Table 74. Amount of anthracnose of bean as shown by examination of cars at destination by inspectors of the Bureau of Markets, 1919.

Origin of shipment	No. of cars with anthracnose	Average percentage of anthracnose	Range of percentage of anthracnose		Remarks as to seriousness of disease.
			No. cars	Percent	
Florida	1	-	-	-	Noticeable amount in every hamper.
Louisiana	6	28	2	50-100	All beans in top, and 50% in lower part, of loads affected.
			1	35-40	Badly decayed.
			2	1-5	Scattering spotted stock.
Maryland	1/2	3	-	3	Badly spotted throughout half of load.
Mississippi	5	13	1	40	In practically every hamper.
			3	1-8	Slight decay.
			1	-	Stock generally had a rusty appearance.
Missouri	1	29	-	25-33	Probably southern grown but reported as coming from Missouri.
South Carolina	1	.3	-	.3	20% of baskets showed 1/3 of contents affected.
Tennessee	1	-	-	-	5% in top of load badly spotted.

Total number of cars with anthracnose - 15 1/2. Total number of cars inspected-48.

Rust caused by Uromyces appendiculatus (Pers.) Lev.

Bean rust occurred in about the same places as usual, although it was probably somewhat less abundant than in 1918. It was reported from Colorado (slight), New Mexico (very common), Kansas, Texas (prevalent on late beans), Louisiana (very common on certain varieties), and practically all other states east of the Missouri and Mississippi Rivers. In the northern section of the United States the disease was probably somewhat less common than usual, although in Wisconsin more than the average was reported. In the south it caused losses to the late planted beans, the early crop escaping injury. Tennessee reported 40% of the late crop affected, Louisiana reported 20-30% of the pole varieties injured, and West Virginia estimated 20% crop injury with 5% loss. In Texas 5% loss to late Kentucky Wonders was recorded while in Georgia 1-2% of the full crop was estimated as lost.

Collaborators mention the disease as first being reported to them as follows:

May 1	Florida
May	Louisiana
July 2	Ohio
July 15	Tennessee
July 15	Virginia
July	Wisconsin
August 1	Georgia
August 19	Minnesota
September 1	Colorado

Only certain varieties were affected with rust. Kentucky Wonder and other pole varieties are mentioned as being especially susceptible in a number of states.

No control measures were mentioned in collaborators' reports of the year.

Mosaic (cause undetermined)

Mosaic had an even wider range than anthracnose or bacterial blight during 1919 as it was reported from a number of western states as well as from the East. Occurrences were reported from Vermont, Massachusetts, Connecticut, New York, Pennsylvania, New Jersey, Virginia, Tennessee, South Carolina, Georgia, Alabama, Mississippi, Louisiana, Texas, Oklahoma, Arkansas, Indiana, Michigan, Wisconsin, Minnesota, Kansas, Colorado, New Mexico, Idaho, and Oregon. Taking the bean crop as a whole it would seem that the disease was somewhat less prevalent than in 1918 although a number of states mention that dry weather tended to obscure the symptoms so that it was difficult to estimate the exact amount of

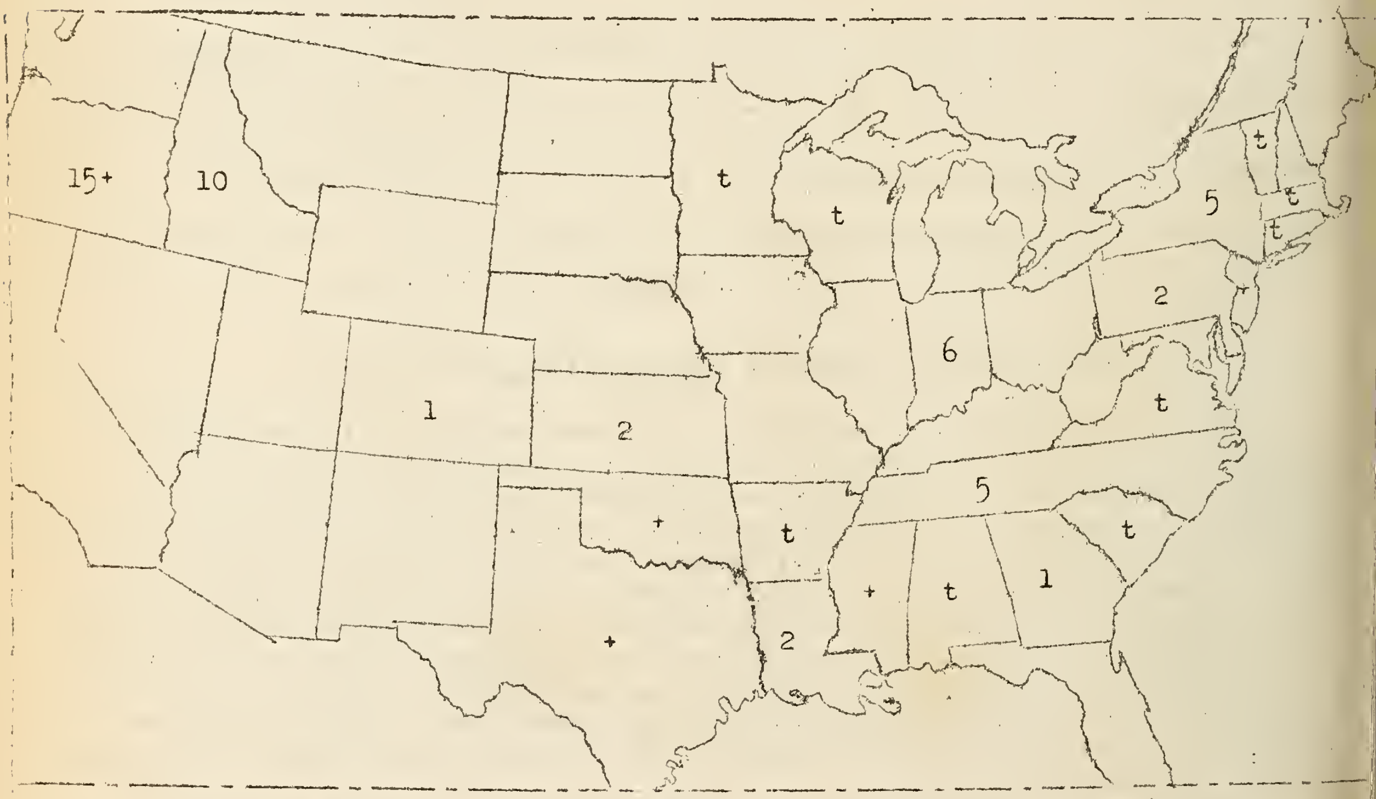

Fig. 41. Estimated percentages reduction in yield of beans from mosaic, 1919.

the disease. In Pennsylvania at least it was much less than last year.

In some states the disease was mentioned as being a rather serious problem. In the bean growing sections of northern Idaho it was general and, according to C. W. Hungerford, probably reduced the crop 10%. In the commercial pea bean section of western New York about 25% of the pea beans were affected with this disease. In Mississippi, where it was common locally, at least one field at Crystal Springs was found with 33% affected plants. Losses in percentages and in bushels will be found in Plant Disease Bulletin, Supplement 12, 1920. The accompanying map, however, gives the tentative estimated percentages of reduction in yield by states.

The dates when the disease was first brought to the attention of collaborators are as follows:

May............. Oklahoma
June 1.......... Tennessee
June 25......... Indiana
July............ Wisconsin
July 2.........Colorado
July 8..........Pennsylvania
July 15.........Vermont

The following varieties were reported affected:

Black Valentine ....Connecticut
Refugee ....University Farm, Minnesota
Kentucky Wonder (late planted).......Texas

No suggestions as to ways in which the disease may be controlled were made by collaborators in reports of 1919.

Powdery mildew caused by *Erysiphe polygoni* DC.

Powdery mildew was reported from Connecticut, South Carolina, Texas (unimportant), and New Mexico (doing damage in some fields).

Stem rots caused by various organisms.

Stem rots caused especially by *Fusarium* and *Rhizoctonia* spp. were reported as occurring rather widely over the country. Trouble of this kind without any cause being mentioned was reported from West Virginia, Tennessee, Georgia, Alabama, Arkansas, and Idaho.

Rhizoctonia sp. was reported as causing root or stem rots in Delaware, New Jersey, Louisiana, Texas, Ohio, Michigan, Colorado, Idaho, and Washington. In most of these states it was not said to be especially serious, but in New Jersey and Delaware considerable damage was reported and in Louisiana the infection was said to be particularly heavy last year, probably on account of the very wet spring; also in Colorado and Idaho root rot, apparently due to Rhizoctonia, was serious where found.

Fusarium sp. was thought to be responsible for certain stem and root troubles in the following states: Massachusetts, New York, South Carolina, Florida, Texas, Oklahoma, Tennessee, Minnesota, North Dakota, Colorado, New Mexico, and Nevada. In New York the cause was *Fusarium martii phaseoli* and it was said to be present in about 75% of the fields, reducing the yield for the state 10%. In Minnesota a report was received from Carlton County, where it was severe in a field that had been planted to beans for the past few years. In Nevada 10% of the crop in Churchill County was said to be injured by a root rot, probably caused by Fusarium.

Southern blight caused by Sclerotium rolfsii Sacc.

This disease occurred in a number of the southern states and was reported from South Carolina and Georgia, where it was about as prevalent as usual, being present in the majority of garden soils, and from Texas, where it was very prevalent on account of the wet weather, causing an estimated loss of about 1%.

Drop and watery soft rot caused by Sclerotinia libertiana Fckl.

This disease was reported as occurring in the field in Alabama, in the greenhouse in Ohio, and in the markets on beans from various states, as follows:

Table 75. Losses from watery soft rot of beans as shown by examination of cars at destination by inspectors of the Bureau of Markets, 1919.

Origin of shipment	No. of cars with decay	Average percentage of decay	Range of percentage of decay	Remarks as to seriousness of decay.
Alabama	3	3	1-5	Slight decay.
Florida	3	32	1 car 75-100	Heavy decay.
			2 cars 5	Slight decay in small nests.
Georgia	1	55	50-60	Some bacterial decay.
Louisiana	7	6	1-30	Slight decay, in nests.
Maryland	3.5	8	1-25	Decay appeared in nests.
Mississippi	6	7	1-35	Decay slight.
South Carolina	1	1	1	Slight decay.
Texas	1	25	25	

Total number of cars with decay - 25.5. Total number of cars inspected - 48.

Root knot caused by Heterodera radicicola (Greef.) Müll.

Root knot was reported from South Carolina (Coastal Plain Section, where it was common, causing 15% crop injury), Florida (common, considerable on late crop), Louisiana (occasional, injury small), and Arkansas (common, 3% injury).

Other diseases.

Root rot caused by Ozonium omnivorum Shear, - reported from Texas and

Oklahoma.

Streak caused by Bacillus lathyri M. & T., - reported as general in Delaware but causing no damage.

Damping off caused by Pythium sp. was reported from Delaware where less than 1% was observed in one field.

Leaf spot caused by Cercospora sp., - reported as prevalent but unimportant in parts of Eastern Texas.

Leaf spot, cause undetermined,- reported from Pierce County, Washington, June 11.

Angular leaf spot caused by Isariopsis griseola Sacc. was reported from Pennsylyania by C. R. Orton. It was collected in the gardens at State College and was generally distributed on a single variety.

Pod blight caused by Phoma sp.,- reported as rather general in Georgia and causing quite a little loss.

Chlorosis (non-parasitic) was prevalent in parts of Texas. The condition seemed to be associated with soils that were too rich in lime.

DISEASES OF ONION

Onion smut caused by Urocystis cepulae Frost.

Smut of onion was reported in 1919 from Vermont, Connecticut, Massachusetts, Pennsylvania, Ohio, Indiana, Wisconsin, Iowa, Missouri, North Dakota, and Oregon. It was usually localized in certain important onion growing sections. In Vermont an area where the disease occurred was discovered last year in Windham County. In Connecticut the disease was serious. In the onion section of Luzerne County, Pennsylvania, and in the Erie County area it was greatly reduced owing to the increase in the practice of the formaldehyde drip method. In Iowa the disease was rather bad in the Pleasant Valley section.

As a whole, the losses were probably about the same as usual, but it was reported from Massachusetts that losses ran higher than normal on account of the wet season. Pennsylvania reported less than usual and Ohio and Oregon reported more. In the latter state it was mentioned that smut was growing worse. Soil disinfection methods for Oregon conditions have not been perfected so as to result in satisfactory control on a practical basis.

Regarding the extent of the losses, C. R. Orton in Pennsylvania reported as high as 20% infection in Luzerne County. In the Chicago onion set district J. C. Walker noted from 50-90% losses of the stand in large areas. He estimated that the average reduction to the crop for that section was about 5%. In Ohio approximately 1% of the crop was reported affected.

In general formaldehyde soil treatment was reported as giving good results. In Massachusetts, Osmun reported gains in yield of from 125% to 345% on one series of experimental plots. In Wisconsin R. E. Vaughan reported results of demonstrations on smut control as follows:

Bulb onions, soil treated	- 212 bushels
Bulb onions, soil not treated	- 50 "
Set onions, soil treated	- 256 "
Set onions, soil not treated	- 128 "

In Racine and Kenosha Counties, Wisconsin, it was estimated by Vaughan that the formaldehyde drip was used on about 100 acres of onions. In the Chicago set district mentioned above Walker stated that the use of formaldehyde drip was very limited, but on account of certain convincing demonstrations of 1919, the onion set contractors will begin to use this method more extensively.

Downy mildew caused by Peronospora schleideni Ung.

Downy mildew was mentioned as having occurred in 1919 only in the states of Pennsylvania, North Dakota, Louisiana, California, and Washington. In California it caused considerable damage to the seed crops in the Santa Clara Valley, according to D. G. Milbrath, but in the other states the loss was evidently very slight.

Neck rot causec by Botrytis sp.

In the field onion neck rot was reported from Ohio, Illinois, Wisconsin, North Dakota, Washington, and Louisiana. Owing to the extremely dry weather of last summer the disease was much less common than usual in the Illinois and Wisconsin onion sections, and in the other states the disease was mentioned as being of only slight importance.

In carload shipments of onions, however, this disease was serious. Inspectors of the Bureau of Markets examining cars in various cities found it common in carloads from many different states. The results of their inspection are given in the following table:

Table 76. Percentages of onion neck rot as determined by food products inspectors of the Bureau of Markets, 1919.

Origin of shipment	No. of cars with decay	Average percentage of decay	Range of percentage of decay		Origin of shipment	No. of cars with deacy	Average percentage of decay	Range of percentage of decay	
			No. cars	Percent				No. cars	Percent
Alabama	1	-	-	-	Michigan	3	4	3	2-7
California	24	8	1	70	Minnesota	2	2	2	2
			23	2-19	Missouri	1	3	1	2-4
Colorado	3	16	1	42	New York	7	8	7	2-20
			2	3	Ohio	11	6	11	2-15
Georgia	1	-	-	-	Oregon	7	5	7	2-12
Illinois	18	9	1	57	Texas	13	9	1	45
			17	1-25				12	2-15
Indiana	1	3	1	3	Washington	5	3	5	2-5
Iowa	5	6	5	2-10	Unknown	1	12	1	12
Kentucky	16	25	8	30-60	Spain	1	22	1	22
Louisiana	1	12	1	0-25					
Massachusetts	4	3	4	1-4					

Total number of cars with decay 125
Total number of cars inspected 1542

Leaf spot caused by *Macrosporium* sp.

In Louisiana this leaf spot is very common on the seed onion crop. It is estimated that not less than from 25-50% of the seed crop was lost on account of it and possibly other associated and contributing causes. Last year, however, was not such a bad year so far as this disease was concerned. It attacks the stems, covering them with a black mold and causing them to rot and fall over. Spraying with Bordeaux is only fairly satisfactory according to C. W. Edgerton.

Macrosporium was also reported from Missouri and Indiana.

Smudge caused by *Vermicularia circinans* Berk.

Smudge was reported as occurring to some extent on White Globe onions in the Indianapolis market garden section of Indiana, in the Chicago set district of Illinois, in the Racine set section of Wisconsin, and in Oklahoma on white onions.

Black mold caused by *Aspergillus niger* Van Tieghem.

Black mold was reported again from California this year by D. G. Milbrath and J. C. Walker. Sixty per cent infection in the Delta region and 10% infection in the Coachella section were reported by D. G. Milbrath. The actual loss from this infection is very difficult to estimate.

This disease was found occurring in a considerable number of cars of onions examined by inspectors of the Bureau of Markets, particularly in cars shipped from California and Texas. Their results are given in the following table:

Table 77. Percentages of black mold caused by *Aspergillus niger* as determined by examination of cars at destination by food products inspectors of the Bureau of Markets, 1919.

Origin of shipment	No. of cars with decay	Average percentage of decay	Range of percentage of decay		Origin of shipment	No. of cars with decay	Average percentage of decay	Range of percentage of decay	
			No. cars	Percent				No. cars	Percent
California	28	15	3	70-80	Texas	15	15	1	90
			25	1-26				14	2-28
Illinois	1	25	1	25	Unknown	4	13	4	2-30
Indiana	1	15	1	10-20					
New York	2	27	1	50	Total number of cars with decay				51
			1	4	Total number of cars inspected				1542

Pink rot caused by *Fusarium malli* Taub.

This disease was reported from Texas as usual, causing a loss of 5%, and from San Joaquin County, California, by Miss E. H. Smith, and also by J. C. Walker as follows:

> "Pink rot appeared for the first time in conspicuous form in the Stockton, California, region. I saw one holding of 2500 acres of onions where it was appearing in spots and causing premature dying of the plants. In this instance it was estimated that about 20 acres were affected to such an extent that the crop would be reduced 50% in these places."

Pink rot apparently caused by Fusarium sp. was also found locally in Indiana. A Fusarium bulb rot was collected in Illinois, Indiana, and Washington.

Watery soft rot caused by Sclerotinia libertiana Fckl.

Watery soft rot was found in five cars of onions inspected by the Bureau of Markets inspectors. These cars originated in California, Illinois, and Texas, and showed rot ranging from 5 to 47%.

Root knot caused by Heterodera radicicola (Greef.) Müll.

Root knot was collected by C. T. Gregory at Akron, Indiana, and reported by him to the Plant Disease Survey. Speciamens were identified in the Office of Soil Technology of the Bureau of Plant Industry.

Other diseases.

Rhizoctonia on onions was collected in Washington.

Rust (Puccinia porri Sow.) An unusually large amount of this rust was found at one place in Connecticut, and it was collected for the first time in Nebraska, according to a report from that state.

Tip burn (non-parasitic) was very prevalent in Indiana, causing as high as 50% loss in some cases and probably reducing the yield for the state about 2%.

Dodder (Cuscuta sp.) was collected in Walla Walla County, Washington.

DISEASES OF CRUCIFERS

CABBAGE and CAULIFLOWER

Club root caused by Plasmodiophora brassicae Wor.

In 1919 club root was reported mostly from the eastern part of the country where it occurred in Vermont, Massachusetts, Connecticut, New Jersey, Pennsylvania, Delaware, West Virginia, Kentucky, Ohio, Indiana, Michigan, Wisconsin, South Carolina, and Georgia. It was also reported from Washington. In Vermont Connecticut, and Ohio it was found on cauliflower as well as on cabbage.

It was reported not to have been observed in New Hampshire, Tennessee, Alabama, Minnesota, Iowa, Arkansas, Louisiana, Texas, Kansas, and Colorado.

Although the disease was rather generally distributed in some states, the loss due to it was not usually reported to be important. In Vermont it was estimated at from 1-5%, in Pennsylvania at 5%, and in Georgia at from 2-3%. In Massachusetts it was said to be as high as 90% in some fields.

The use of heavy applications of lime was said to give good, although by no means perfect results in controlling the disease in Massachusetts and Ohio.

Yellows caused by *Fusarium conglutinans* Woll.

Yellows was found in 1919 in most of the central, southern, and western states - practically the same distribution as in 1918. It was reported not to have been observed in the New England States, Colorado (present in 1918), and Washington. It was reported from New Jersey, Pennsylvania, Delaware, Maryland, Virginia, Georgia, Alabama, Mississippi, Tennessee, Kentucky, West Virginia, Ohio, Indiana, Illinois, Michigan (? - one suspected case), Wisconsin, Iowa, Nebraska, Kansas, Missouri, Arkansas, Louisiana, Texas, and Oklahoma.

The disease was apparently less serious than usual in Pennsylvania, Wisconsin, and Alabama. In Indiana, Tennessee, Mississippi, Louisiana, Texas, Arkansas, and Kansas, on the other hand, it seemed to be increasing in prevalence and severity. In Indiana it was said to have become the limiting factor in the growing of cabbage for market. In Mississippi it was the most prevalent and most destructive disease of cabbage, causing a loss of possibly 5%. In Louisiana it was very abundant and caused considerable loss. The practice of using plants shipped in from other states was thought to be responsible for the very rapid spread of the disease in that state. In Kansas yellows was said to be more prevalent than ever before, causing losses ranging from 10-50%. In Arkansas the loss was estimated at 10%, and in Texas at 4%. In Tennessee the disease was very common, and particularly destructive in the western section, where it caused losses in some cases as high as 90%. In Maryland, Ohio, Iowa, and Georgia, the disease was about as prevalent as usual and caused considerable losses, 10% being estimated in Georgia. In the other states where it occurred it was local or where general caused only slight losses.

Dates when the disease was first noticed were reported as follows:

April	Louisiana	June 17	Indiana
May 17	Oklahoma	June 18	Ohio
May 28	Georgia	June	Wisconsin
May	Mississippi	August 30	Pennsylvania
June 15	Missouri		

In Indiana the varieties Copenhagen and Wakefield were severely affected, while Louisville showed resistance. The use of wilt resistant strains was said to be responsible for the small loss in Wisconsin, and they also gave good results in Ohio. It is apparently the only successful method of controlling this disease. Crop rotation does not seem to eliminate it. One case, said to be authentic, was reported from Ohio where the organism remained in the soil after a nine year period of rotation.

Black-leg caused by *Phoma lingam* (Tode.) Desmaz.

Black-leg was reported from New Jersey, Pennsylvania, Delaware, Maryland, South Carolina, Ohio, Indiana, Kentucky, Wisconsin, North Dakota, Iowa, Missouri, Arkansas, Alabama, Mississippi, and Louisiana. It was reported not to have been found in New Hampshire, Vermont, Massachusetts, Connecticut, Tennessee, Michigan, Minnesota, Oklahoma, Colorado, Washington, and Oregon.

In Pennsylvania the disease was apparently more prevalent than usual. In Wisconsin it was said to be one of the most destructive diseases of cabbage, causing heavy losses especially in the Outagamie and Brown County districts, where it was more severe than in Racine and Kenosha Counties. The disease caused losses also in New Jersey, Maryland, South Carolina, Iowa, Missouri, Arkansas, Mississippi, and Alabama. In the other states where it occurred it was present in small amounts and caused no loss.

The disease was first reported on the following dates:

May	South Carolina	July 10	Ohio
May	Wisconsin	July 19	Indiana
June 1	Missouri	October 10	Pennsylvania

The heavy spring rains in Wisconsin favored the spread of the disease. According to J. C. Walker (Phytopath. 10: 64, 1920), "Rainy periods seem essential for dissemination of the fungus from primary centers. Correlation of rainfall and occurrence of disease in various localities indicates that weather conditions during growth of seed bed are very important in development of epiphytotics."

In Pennsylvania the Danish Ball Head and Danish Round Head varieties were apparently most susceptible.

Seed sterilization was said to give good results in Arkansas. In Wisconsin, on the other hand, the disease was prevalent in spite of seed disinfection. J. C. Walker reported that "Seed treatment within limits of injury to germination is not completely effective."

Black rot caused by *Bacterium campestre* (Pam.) E. F. S.

In 1919 black rot was found in Massachusetts, Connecticut, New Jersey, Pennsylvania, Delaware, Virginia, South Carolina, Florida, Ohio (also on cauliflower), Indiana, Wisconsin, Missouri, Kentucky, Tennessee, Louisiana (specimen collected by L. R. Hesler and identified in the Office of Cotton, Truck, and Forage Crop Disease Investigations), Texas, Oklahoma (one report), Kansas, and Nebraska. In Colorado it was said to be probably present, although it had not been observed.

It was reported not to have been found in New Hampshire, Vermont, Iowa, Arkansas, and Washington.

The disease was said to be general in Pennsylvania, Virginia, Tennessee, Wisconsin, Missouri, and Texas. In Pennsylvania the loss caused was estimated at 7.5%, and in Tennessee it ranged from 10-25% in infested fields. In Wisconsin, where it was thought to have been introduced with infected seed, it was said to be one of the most important diseases, causing losses as high as 70% in some fields, though the average loss was moderate. In other states black rot was not reported to be especially important, although in some cases individual fields were severely infested.

Heavy rains in Wisconsin caused widespread infection. In the same state seed treatment with mercuric chloride proved very satisfactory as a means of control.

This rot did not seem to be prevalent or important on cabbage in transit. It was reported in only four cars (from Alabama, Michigan, New York, and Virginia) out of a total of 1423 cars examined by inspectors of the Bureau of Markets.

Damping-off caused by Corticium vagum solani Burt.

Rhizoctonia was reported from New Jersey, Florida, Ohio, Indiana, Missouri, and Washington. In most cases it occurred as a damping-off fungus, but in Washington it caused a root-rot also. In all cases it was local in distribution and did little damage. Seed bed sanitation and proper cultural methods were recommended from Florida as a means of control.

Root knot caused by Heterodera radicicola (Greef.) Müll.

Root knot was reported only from South Carolina and Texas in 1919. In the former state it was said to be common, causing 25% injury to the crop and a loss estimated at 2%. In Texas it was unimportant, occurring only in traces.

Downy mildew caused by Peronospora parasitica (Pers.) De Bary.

Downy mildew was reported as local and unimportant in South Carolina, Alabama, Mississippi, Iowa, and Texas. According to D. C. Milbrath, the disease was prevalent and severe on cauliflower in the vicinity of Sacramento, California.

Slimy soft rot caused by Bacillus carotovorus Jones.

Slimy soft rot was a rather important field disease in Vermont, Pennsylvania, and Louisiana, causing damage estimated at 2-5% in Vermont and 5% in Pennsylvania, and also causing considerable loss in Louisiana. In Pennsylvania it was said to be more prevalent and more destructive than was generally supposed. The disease was found also in the field in Delaware and Kentucky, where it was not important: in Ohio, where it was said to be more prevalent than usual; and in Wisconsin, where, although common, it caused very slight loss.

Slimy soft rot was very prevalent on cabbage in transit, being found in practically every car inspected. In some cases it caused severe losses but in the majority of instances only a few outer leaves were involved.

Black mold caused by Alternaria brassicae (Berk.) Sacc.

Black mold or black leaf spot was reported from Pennsylvania, Delaware, South Carolina, Florida, Ohio, Kentucky, Indiana, Wisconsin, Alabama, Mississippi, Louisiana, Texas, and California. In South Carolina the loss caused was estimated at 1%, in Georgia at from 2-3%, and in California at 3% in the vicinity of San Francisco, where it was also prevalent on broccoli, according to D. G. Milbrath. At Los Angeles it occurred on cauliflower.

The disease did not seem to be important in the other states from which it was reported.

Black mold occurred on cabbage and cauliflower in trnasit, but in most cases reported the damage was slight, affecting mostly the outer leaves.

Other diseases and injuries.

Leaf spot caused by *Bacterium maculicolum* McCulloch was reported as general in southern Alabama. A disease thought to be due to the same organism was observed by L. R. Hesler in the vicinity of Crystal Springs, Mississippi; New Orleans, Louisiana; and Houston, Texas. Specimens of the disease on cauliflower were received by Miss McCulloch from New York and Florida.

Drop caused by *Sclerotinia libertiana* Fckl. was reported from Indiana, Alabama, Mississippi, Louisiana, Texas, and California. It was apparently not important in the field except in Louisiana, where it caused a loss estimated at 10%, and in Texas, where it was said to be present in every field, In Alabama it was said to be "conspicucus by its absence", only traces having been found on cabbage.

Wilt caused by *Sclerotium rolfsii* Sacc. was reported from Texas and Alabama as unimportant.

Pleospora sp. was reported by D. G. Milbrath as "frequent in conjunction with other diseases" in California.

Powdery mildew, probably caused by *Erysiphe polygoni* DC., was reported by L. R. Hesler to be severe on occasional plants in nearly every field of early cabbage in the vicinity of San Benito, Texas.

Ring spot caused by *Mycosphaerella brassicicola* was found by D. G. Milbrath to be severe during all seasons of the year on cabbage, cauliflower, and broccoli, both in the field and in transit, in the vicinity of San Francisco. The loss caused was estimated at 30%.

Decay caused by *Botrytis* sp. was reported by D. G. Milbrath as frequent in late cabbage (maturing in May, June) in southern California; and also earlier in the year following ring spot and causing slimy rot.

Leaf spot caused by an undetermined species of Phoma was found at Mt. Vernon, Skagit County, Washington.

Leaf infection by *Fusarium* sp. was reported by D. G. Milbrath from California as severe on cabbage and broccoli in conjunction with Mycosphaerella and Alternaria.

A *purple spotting*, thought not to be due to Phoma, of the stems and branches of cabbage was found occasionally in Washington.

A *leaf spot* resembling the Alternaria leaf spot was said to be common in the vicinity of La Conner, Washington.

"*Leaf speck*", cause unknown, was locally rather severe in Florida, according to G. K. K. Link.

An *undetermined disease* of cabbage was reported by L. R. Hesler as general in Louisiana in the region south of New Orleans, affecting 75% of the plants in some fields. It caused a brownish spot bordered by a yellow band, usually appearing at the margin of the leaves. It was said to resemble slightly a condition found in the same state in 1918.

A peculiar trouble of unknown origin, which caused a thickening and mottling and finally the death of the leaves, was found by L. R. Hesler near Crystal Springs, Mississippi.

An undetermined root rot was reported from Nebraska.

Tip-burn (non parasitic) was reported from Indiana (not common).

Nitrate injury was reported from Alabama. According to L. R. Hesler the injurywas in some cases confused with that caused by downy mildew, bacterial blight, and black mold; although in other cases it was evidently due to nitrate burning.

Lightning injury, which caused the death of all plants in an area probably 30 feet in diameter, was reported from the vicinity of Crystal Springs, Mississippi, by L. R. Hesler.

CHINESE CABBAGE (Brassica pekinensis)

Leaf spot caused by Cylindrosporium brassicae was reported from Missouri (rare; 60% injury where found).

HORSE RADISH

White rust caused by Albugo candida (Pers.) Roussel was reported from Ramsey County, Minnesota.

Root rot caused by Thielavia basicola (B. & Br.) Zopf. was said to be very common in one locality in New Jersey.

Leaf spot caused by Alternaira brassicae (Berk.) Sacc. was reported from Missouri (Scott County; local, damage slight).

Leaf spot caused by Cercospora armoraciae Sacc. was reported from Scott County, Missouri.

A bacterial root rot was reported from New Jersey as very common and destructive in one locality.

Black streak, cause undetermined, was reported from Pierce County, Washington.

KALE

Club root caused by Plasmodiophora brassicae Wor. was reported from King County, Washington.

Yellows caused by Fusarium conglutinans Woll. caused considerable loss locally in Indiana. It was said to be especially common on kale following badly diseased cabbage.

Rhizoctonia was reported from Washington.

MUSTARD

White rust caused by Albugo candida (Pers.) Roussel,- reported from

Minnesota on Brassica nigra.

Wilt caused by Fusarium sp., - reported from North Dakota.

RADISH

Club root caused by Plasmodiophora brassicae Wor. was reported from Minnesota (Ramsey County).

Black root caused by Rheosporangium aphanidermatus Edson was said to be very severe in certain market gardening sections of Indiana, particularly on clay soil. White varieties were most affected. The disease was severe also in Mississippi at Long Beach, where in one field at least 75% of the radishes were badly diseased.

White rust caused by Albugo candida (Pers.) Roussel was reported from Indiana (common in greenhouses), Minnesota (slight), Mississippi (heavy infection at Long Beach), and North Dakota (Cass County, slight).

Crown rot caused by Sclerotinia sp. was reported from Indiana, where it was found occasionally in greenhouses on the white varieties.

Scab thought to have been caused by Actinomyces scabies (Thax.) Güssow was reported from Indiana (rare, no loss).

RUTABAGA

Black rot caused by Bacterium campestre (Pam.) E. F. S., - reported from Minnesota.

Powdery mildew caused by Erysiphe polygoni DC.,- reported from Washington.

Leaf spot, said to be similar to that caused by Cercospora on turnip, was reported by L. R. Hesler as causing moderate damage in a planting at Long Beach, Mississippi.

TURNIP

Black rot caused by Bacterium campestre (Pam.) E. F. S.,- reported from Minnesota (Beltrami County, October 30).

Soft rot caused by Bacillus carotovorus Jones,- reported from Alabama (Chilton County).

Club root caused by Plasmodiophora brassicae Wor.,-reported from Connecticut (one report in old soil, little injury).

White rust caused by Albugo candida (Pers.) Roussel was reported by L. R. Hesler from Mississippi and Louisiana. It caused little damage.

Downy mildew caused by Peronospora parasitica (Pers.) De Bary was reported by L. R. Hesler as generally prevalent but causing little damage in the vicinity of Dickinson, Texas.

Powdery mildew, probably caused by Erysiphe Polygoni DC. was reported from Texas by L. R. Hesler (traces observed in every patch visited, not doing any apparent damage).

Cercosporella albo-maculans E. & E.,- reported from Mississippi (one report; Lawrence County).

Leaf spot, thought to have been caused by Cercospora sp.,- reported from Mississippi by L. R. Hesler.

Leaf spot, caused by Macrosporium herculeum E. & M.,- reported from Alabama (Washington County).

An Alternaria leaf spot said to be abundant in nearly every field was collected in Texas by L. R. Hesler.

Root knot caused by Heterodera radicicola (Greef) Müll. was said to be common in South Carolina, causing a loss estimated at 1%.

DISEASES OF CUCURBITS

CANTALOUPE

Leaf blight caused by Alternaria brassicae nigrescens Pegl.

In 1919 leaf blight was reported to be abundant and prevalent, as usual, in New Jersey, Delaware, Indiana, Arkansas, Texas, and Southern California. The greatest amounts of injury to the crop were reported from Delaware (10-20%) and from Indiana (80%). In Arkansas leaf blight was said to have caused less damage then usual, although it was the most serious disease of cantaloupe in that state. The injury in Arkansas was estimated at 5%. In Texas a loss of 2% was reported. It was also reported from Wisconsin, causing slight damage.

In Arkansas the Pollock resistant strains, said to have been used almost exclusively by growers, and the favorable weather conditions reported, were probably factors in reducing the loss from the disease.

Bacterial wilt caused by Bacillus tracheiphilus E. F. S.

In 1919 bacterial wilt was reported from Connecticut, New Jersey, Pennsylvania, Delaware, Virginia, South Carolina, Ohio, and Indiana. In most of these states it was local in distribution, but in New Jersey it was said to be common and sometimes destructive. In Delaware also it was common on susceptible varieties, such as Honey Dew, causing injury estimated at 1-2%. In Indiana it was the most serious disease of cantaloupe, and was said to be even more serious than usual in 1919.

Anthracnose caused by Colletotrichum lagenarium (Pass.) Ell. & Hals.

Anthracnose was reported from New Jersey, Delaware, Virginia, South Carolina, Georgia, Florida, Ohio, Wisconsin, Minnesota, Tennessee, Arkansas, Texas, and Oklahoma. In most of these states it was local or unimportant, but in Delaware and Georgia the damage due to it was estimated at from 3-5%

and at 25%, respectively; and was reported to be causing considerable loss in Minnesota, in spite of spraying with Bordeaux, which had been practiced for several years. The use of Bordeaux was also said to be only fairly successful in controlling the disease in Florida.

Inspectors of the Bureau of Markets reported anthracnose to be causing bad decay in shipments of cantaloupes from Colorado (5 cars) and from Maryland (one car).

Mosaic (cause undetermined).

Mosaic was reported as local or unimportant in Connecticut, New Jersey, Indiana, Wisconsin, and Texas. In Maryland the disease caused a loss estimated at 2%. In California, the disease was very serious in the San Joaquin Valley in the vicinity of Turlock, where about 7000 acres of cantaloupes are grown. According to D. G. Milbrath, the average loss in that section was 60%, with total losses in some fields. The loss in casaba melons in the same region was 5%.

Downy mildew caused by Pseudoperonospora cubensis (B. & C.) Rostow.

Downy mildew was reported in 1919 from Connecticut, New York, New Jersey, Delaware, South Carolina, Georgia, and Florida. In Delaware and South Carolina the disease was local. Some injury was reported from Connecticut and New Jersey; and in Florida the loss was estimated at 5-10%. In New York it was said that considerable damage was caused by this disease in Columbia County, when spraying was not practiced.

The use of Bordeaux mixture was said to be fairly successful in controlling the disease in Florida.

Southern blight caused by Sclerotium rolfsii Sacc.

Southern blight was reported as local in South Carolina; and prevalent in Georgia and Texas, causing losses estimated at 15% in the former, and 1% in the latter state.

Wilt caused by Fusarium niveum E. F. S.

Fusarium wilt was reported from South Carolina, Ohio, Louisiana, and California. In no case was it said to be important.

Fruit rot caused by Fusarium sp. and Botrytis sp.

The most important of the various fruit rots of cantaloupe reported as contributing to losses in transit were caused by Fusarium sp. and Botrytis sp. The following tables show losses due to these two organisms as reported by inspectors of the Bureau of Markets.

Table 78. Losses from Fusarium rot caused by _Fusarium_ sp. as shown by examination of cars at destination by inspectors of the Bureau of Markets.

Origin of shipment	No. of cars with decay	Average percentage of decay	Range of percentage of decay		Remarks as to seriousness of decay.
			No. cars	Percent	
Arkansas	15	5	–	1-20	Mostly slight decay.
Arizona	3	12	1	10-20	Fusarium and black rot.
			2	3-25	Fusarium rot only.
California	24	11	–	2-40	Most of cars onlyslight decay.
Colorado	4	5	1	8-10	Fusarium and Rhizopus rots.
			3	2-5	Slight decay.
Delaware	2	6	–	1-10	Slight decay.
Georgia	1	45	–	10-60	Heaviest decay in two upper layers.
Maryland	4	36	1	90	Mostly anthracnose associated with Fusarium and gray mold rots.
			3	8-30	

Total ... 53   Total number of cars inspected 572

Table 79. Losses from gray mold rot caused by _Botrytis_ sp. as shown by examination of cars at destination by inspectors of the Bureau of Markets.

Origin of shipment	No. of cars with decay	Average percentage of decay	Range of percentage of decay		Remarks as to seriousness of decay.
			No. cars	Percent	
Arizona	2	6	–	2-10	Slight decay.
California	16	41	3	60-100	All stages of decay.
			4	33-50	Mostly superficial decay.
			9	2-13	Mostly slight decay.
Delaware	1	2	–	2	Slight decay.
Maryland	5	25	1	90	Heavy decay, mostly complete. Estimate of decay includes other rots.
			4	2-20	
Michigan	1	100	–	100	Superficial mold, affecting appearance only.
New Mexico	3	12	–	5-20	
North Carolina	2	83	–	66-100	

Total 30   Total number of cars inspected 572

Other diseases.

Leaf blight, cause not given, was reported as causing considerable loss in Maryland. One field was said to be a complete loss.

Tip burn, cause unknown, was common and serious in Indiana, probably because of drought in July.

Bacterial soft rot was reported by inspectors of the Bureau of Markets to be causing decay in 9 cars, from the following states: Arkansas, 1 car; California, 5 cars; Delaware, 2 cars; and Georgia, 1 car.

Root knot, caused by Heterodera radicicola (Greef.) Müll., was said to be common in South Carolina, causing a loss of 3%. D. G. Milbrath reported that in the Imperial Valley of California it caused a loss of 60% in some fields, averaging 5%; and in the vicinity of Turlock, in the same state, the loss due to this disease was 1%.

CUCUMBER

Bacterial wilt caused by Bacillus tracheiphilus E. F. S.

Bacterial wilt was reported in 1919 from Connecticut, New Jersey, Pennsylvania, Delaware, Virginia, South Carolina, Ohio, Indiana, Michigan, Wisconsin, Iowa, Missouri, Kansas, Texas, Arizona, and Colorado. The report from Arizona is the first received by the Survey from that state. A disease which was thought to be bacterial wilt was observed in Louisiana.

In Connecticut, South Carolina, Ohio, Michigan, Wisconsin, Iowa, Missouri, and Texas, the disease was of no particular economic importance, although in Wisconsin it was said to be much more prevalent than usual. Indiana, where it was serious, also reported more than usual, especially in greenhouses. Estimated losses were reported from some of the other states as follows: Pennsylvania (50% in Lehigh and Philadelphia Counties), state average 3%; Louisiana 5%; Colorado 5-10%; Arizona (50-60% in two counties), state average 3%.

Dates when the disease was first observed were reported by collaborators as follows:

July 1 (greenhouse)...Connecticut
July 2 ....Wisconsin
July 24.............. Colorado
August 9 .... Ohio
August 30......... Pennsylvania

Mosaic (cause undetermined)

Mosaic was reported from Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, South Carolina, Florida, Ohio, Indiana, Michigan, Wisconsin, Minnesota, Iowa, Louisiana, Texas, and Kansas.

Connecticut, New Jersey, and Michigan reported less than usual. In Indiana, also there was less mosaic in the field, but in greenhouses it caused considerable loss. In Wisconsin the disease, although widespread, appeared too late in the season to do much damage. From Massachusetts mosaic was reported as more prevalent than usual and as causing large losses in the field.

In the other states from which it was reported it occurred about as usual, and was apparently not important except in New York and in Pennsylvania where the loss in Northampton County was estimated at 25%.

In parts of Wisconsin mosaic was found affecting wild cucumbers more severely than the cultivated plants. Experiments by Doolittle have shown that the disease is carried by insects from the wild to the cultivated plants.

Anthracnose caused by Colletotrichum lagenarium (Pass.) Ell. & Hals.

Anthracnose was reported from Massachusetts, New Jersey, Pennsylvania, Virginia, South Carolina, Ohio, Indiana, Wisconsin, Minnesota (not reported but probably present), Iowa, Alabama, and Texas; and from Arizona and North Dakota for the first time.

The disease was mostly local, or where general caused slight damage, but in New Jersey it was said to be severe, and in Indiana it was rather serious in greenhouses, especially where an overhead system of irrigation was used.

Anthracnose caused some loss in shipments of cucumbers, as shown in the following table:

Table 80. Losses to cucumber from anthracnose caused by Colletotrichum lagenarium as determined by inspectors of the Bureau of Markets, 1919.

Origin of shipment	No. of cars with decay	Average % of decay	Range of percentage of decay
Florida	5	28	2 cars - 2-3 3 cars - 30-65
New York	1	10	10
North Carolina	1	10	10

Total number of cars with decay - 7. Total number of cars inspected - 111

Dates of first appearance of the disease were reported as follows:

June 2	Ohio	August 25	Wisconsin
June 18	Indiana	August 30	Pennsylvania

Seed treatment and crop rotation were said to give good results in Wisconsin, but as the disease gave little trouble, these measures were not generally practiced.

Downy mildew caused by Pseudoperonospora cubensis (B. & C.) Rostow.

In 1919 downy mildew was reported from Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, South Carolina, Georgia, Florida, Louisiana, Arizona, and California. Arizona reported the disease to the Survey for the first time. Although not reported as occurring in West Virginia, it was probably present to an injurious extent in some sections, according to N. J. Giddings.

In Massachusetts the disease appeared too late to cause much reduction.

of the crop, and in North Dakota the dry season prevented its general development. In other states it caused more or less injury, resulting in considerable losses in some cases, especially in Florida in the late crop, Arizona, and California. In Arizona the loss in one county was estimated at 40%. In California D. G. Milbrath reported 30% loss in the vicinity of Alameda.

Spraying with Bordeaux gave satisfactory results in Florida. Dusting with sulphur, which was practiced in California injured the foliage and was not successful in controlling the disease.

Angular leaf spot caused by Bacterium lachrymans E. F. S. & Bryan.

Angular leaf spot was reported from South Carolina, Michigan, Indiana, Wisconsin, Iowa, and North Dakota (first report received by the Survey). It was unimportant in most cases, but in South Carolina it caused a loss of 10% in field and shipments.

One case was reported from Michigan where the disease had developed in new ground from three year old seed.

Scab caused by Cladosporium cucumerinum Ell. & Arth.

Scab was reported as follows: Pennsylvania (very generally prevalent on about 100 acres in Cambria County near Johnstown where the average loss was 50%; weather conditions apparentlyvery favorable for the disease; reported September 18); South Carolina (local); Wisconsin (several reports received; evidently doing some damage in isolated fields; loss a trace; reported in August).

Other diseases

Leaf spot caused by Alternaria brassicae nigrescens Pegl. was said to be severe in New Jersey.

Stem rot caused by Sclerotinia libertiana Fckl. was reported from New Jersey, where it was occasionally severe in the field, probably due to wet weather. A fruit rot due to this fungus caused losses in carlot shipments from various states, as shown in the following table:

Table 81. Losses from watery soft rot of cucumber caused by Sclerotinia libertiana as determined by food products inspectors of the Bureau of Markets, 1919.

Origin of shipment	No. of cars with decay	Average % of decay	Range of percentage of decay
Arkansas	1	2	2
Florida	1	10	5-15
Louisiana	3	13	8-22
Missouri	1	11	10-12
New York	1	1	1
Unknown	2	38	1 car - 5 1 car - 70

Total number of cars with decay - 9. Total number of cars inspected - 111

Damping-off caused by Pythium debaryanum Hesse was reported from Minnesota (severe infection during rainy weather of June in the plots on University Farm).

Damping-off caused by Rhizoctonia sp. was reported from Washington (Island and King Counties; first report June 16).

Wilt caused by Fusarium niveum E. F. S. was reported from Ohio.

Soft rot caused by Bacillus sp. was said to be common in Florida in Pasco and De Soto Counties. Control measures recommended were spraying the plants with Bordeaux and sanitary packing of the fruit.

Root knot caused by Heterodera radicicola (Greef.) Müll. was reported as follows: Florida (a three-acre field of cucumbers planted in an experimental way practically ruined as a result of nematodes; reported by J. Rosenbaum), Louisiana (prevalent, considerable loss), Ohio (commonly found in greenhouses; more prevalent than usual in the field; soil steaming gives good results), South Carolina (common; injury 30%, estimated loss 3%), Texas (traces, estimated loss 1%).

Injury from frost and drought were reported from Washington.

SQUASH

Bacterial wilt caused by Bacillus tracheiphilus E. F. S. was reported from California by D. G. Milbrath as present in small amounts in all parts of the state.

Downy mildew caused by Pseudoperonospora cubensis (B. & C.) Rostow was reported from New Jersey, where it caused slight loss.

Wilt caused by Fusarium sp. was prevalent in Texas, and local in California (Orange County).

Mosaic, cause undetermined, was reported from Pennsylvania on crook-neck squash, causing little aggregate injury to the crop, although it was very destructive to the plants attacked. The fruit on affected plants was hardly worth harvesting and was affected much as in the case of cucumbers with mosaic. It was also reported as very prevalent and causing considerable loss in Louisiana, and as severe in the Turlock section in California, causing a loss estimated at 25%.

WATERMELON

Anthracnose caused by Colletotrichum lagenarium (Pers.) E. & H.

Anthracnose was reported in 1919 from New Jersey, Delaware, Maryland, South Carolina, Georgia, Florida, West Virginia, Indiana, Michigan, Kentucky, Tennessee, Alabama, Louisiana, Texas, Oklahoma, Arkansas, and Kansas.

Dry weather in Indiana and Kansas, and hot weather in Louisiana prevented the occurrence of more than a trace of the disease in those states. The heaviest losses from anthracnose were reported from the Atlantic Coast States, as follows: Delaware, loss 10%; Maryland, loss 10-15%; South Carolina, injury

25%, loss 10%; Georgia, about 10% loss; Florida, loss considerable. In most of the other states reporting its presence the disease was local, except in Alabama, Texas where it caused a loss estimated at 2%, and Arkansas, where it caused 10% injury, affecting mostly the leaves.

Anthracnose was common in shipments of watermelons from various states. The following table shows the amounts of anthracnose reported by inspectors of the Bureau of Markets.

Table 82. Percentage of anthracnose caused by Colletotrichum lagenarium as shown by inspectors of cars at destination by inspectors of the Bureau of Markets, 1919.

Origin of shipment	No. of cars with decay	Average percentage of decay	Range of percentage of decay		Remarks as to seriousness of decay.
			No. cars	Percent	
Alabama	2	8	-	5-11	
Arkansas	1	3	-	3	
Delaware	3	37	2	1-10	Decay occurred in spots.
			1	100	Bad decay, affecting all melons.
Florida	40	35	25	2-25	Mostly spots.
			6	30-48	Bad decay in some cars.
			11	70-100	Stock practically worthless in some cars; in others one-half showed bad decay.
Georgia	102	27	63	1-25	Decay mostly in spots.
			25	28-50	
			14	55-100	Very bad decay.
Illinois	6	7	-	1-17	Mostly slight.
Indiana	3	13	-	4-30	Mostly in spots.
Maryland	4	5	-	2-10	Slight decay.
Missouri	7	37	4	2-25	Mostly slight decay.
			3	70-75	In advanced stages.
North Carolina	40	47	17	2-25	Mostly slight decay.
			9	30-55	
			14	72-100	Mostly advanced stages.
Ohio	1	2	-	2	Affecting appearance only.
Oklahoma	2	24	-	23-25	Affecting appearance only.
South Carolina	45	37	22	2-25	Mostly slight decay.
			12	30-50	
			11	60-100	In advanced stages.
Texas	25	13	20	2-25	Mostly slight spotting.
			3	30-45	
			2	65-100	Mostly in advanced stages.
Unknown	6	34	4	10-35	Affecting appearance only in some cars.
			2	50-75	Severe decay.

Total ... 287   Total number of cars inspected ... 584.

The following dates when the disease was first observed were reported by collaborators:

May 10 .... Georgia
May 27 .... Florida
June .... Arkansas
June 1............ South Carolina
July 24........... Indiana
October 30........ Oklahoma

The use of Bordeaux gave good results in South Carolina and Florida.

Stem end rot caused by Diplodia sp.

Stem end rot was reported as occurring in the field in Maryland, Tennessee, Louisiana, Iowa, Arizona(first report of this disease received by the Survey), and New Mexico. The loss caused was estimated at from 3-4 in Maryland, and about 1% in Arizona. From New Mexico the disease was reported as affecting as high as 15-20% of the melons in some places.

Stem end rot was more important on melons in transit. It was reported by inspectors of the Bureau of Markets as having been found in carloads from various states, as shown in the following table.

Table 83. Percentages of stem end rot caused by Diplodia sp. as determined by inspectors of the Bureau of Markets, 1919.

Origin of shipment	No. of cars with decay	Average percentage of decay	Range of percentage of decay	
			No. of cars	Percent
Alabama	3	8	-	2-15
Arkansas	2	9	-	8-10
Florida	62	17	50	1-25
			8	27-40
			4	55-100
Georgia	156	19	129	1-25
			23	27-50
			4	55-100
North Carolina	15	9	-	2-25
Oklahoma	5	10	-	4-15
South Carolina	41	16	33	1-25
			6	35-45
			2	55-90
Texas	46	12	-	1-40
Unknown	7	13	6	1-15
			1	45

Total............337 Total number of cars inspected 584

Stem end rot was also found in watermelons consigned from Indiana, Illinois, Missouri, Ohio, and Wisconsin, but on account of the supposedly southern range of this disease it is possible that the melons may have been grown in other states, or perhaps, other organisms were concerned.

Blossom end rot, cause unknown.

Blossom end rot was reported from Delaware (2-4%, general), Indiana (common late in season, August 22), and Idaho (probably Fusarium sp., serious where reported; in Bonner, Latah, Nez Perce, and Elmore Counties).

Blossom end rot also caused some loss of melons in transit. It was reported by Bureau of Markets inspectors in carloads from the following states: Florida, 3 cars, 1-10%, average 4% decay; Georgia, 2 cars, 2-10%, average 6% decay; North Carolina, 1 car, 30% decay; South Carolina, 4 cars, 5-20% in 3 cars, 50% in 1 car, average 20% decay.

Wilt caused by Fusarium niveum E. F. S.

Fusarium wilt was reported in 1919 from Virginia, South Carolina, Georgia, Florida, Ohio, Indiana, Louisiana, Texas, Arizona, Kansas, and California.

In Virginia, South Carolina, Ohio, Louisiana, Kansas, and Arizona the disease was not important. In Florida it was common, causing injury ranging from 1-3%. In Georgia it was also generally prevalent, causing injury as high as 30%, resulting in a loss estimated at from 5-6%. Weather conditions in Georgia favored the disease, as also in Texas, where a loss of 8% was reported. In California, according to D. G. Milbrath, the disease was severe in the vicinity of Turlock in the San Joaquin Valley. In Indiana Fusarium wilt was reported to have become the limiting factor in the watermelon industry, not only making long time rotations necessary, but preventing the growing of watermelons in some sections.

Dates when the disease first appeared were reported by collaborators as follows:

April 20	Florida	July 23	Virginia
July 1	Georgia	August 18	Ohio

Control measures reported as used in Florida were seed and field sanitation and crop rotation.

Other diseases.

Alternaria leaf spot caused by Alternaria sp. was reported from Ohio, and from Indiana where it was common but caused no particular loss.

Leaf rot caused by Cercospora citrullina Cke. was reported from Texas as prevalent and causing a loss estimated at 2%.

Bacterial wilt caused by Bacillus tracheiphilus E. F. S. was said to be local in South Carolina.

Stem rot caused by Mycosphaerella citrullina (C. O. Sm.) Gros. occurred in Florida, where it first appeared April 18, and was said to be fairly common. It was also reported from Louisiana, where it was occasional and caused slight loss. Control measures recommended in Florida were seed disinfection and spraying with Bordeaux.

Stem rot caused by Sclerotinia libertiana Fckl. was said to be common in New Jersey, probably due to wet weather.

Southern blight caused by Sclerotium rolfsii Sacc. was local in South Carolina.

Stem rot caused by Rhizoctonia sp. was said to have caused considerable injury in some sections of Louisiana. It was first observed in June.

Root knot caused by Heterodera radicicola (Greef.) Müll. was reported from South Carolina as common, causing 50% injury to the crop, and a loss estimated at 5%. It was also reported from California, where it was severe in the vicinity of Turlock, according to D. G. Milbrath.

Stem-end rot due to adverse weather and soil conditions was common in Florida, causing injury which was probably not over 1%. Proper cultivation to conserve moisture in the soil was suggested as a method of control.

DISEASES OF MISCELLANEOUS CROPS

ARTICHOKE (Globe)

Botrytis sp. was reported by D. G. Milbrath as occurring on overmature and stunted heads in the Half Moon Bay section of California.

ARTICHOKE (Jerusalem)

Mildew caused by Plasmopara halstedii Earl. was reported from Vermont, where it caused small loss.

ASPARAGUS

Rust caused by Puccinia asparagi DC.

Rust was reported from at least twenty widely scattered states, particularly in the northern and central portions of the country. For the most part it occurred in about the usual amounts, but was said to be less prevalent than usual in Vermont, Ohio, and Georgia. In the last-named state asparagus beds heavily infested in 1918 were practically free from rust in 1919. In most states distribution was local and the aggregate losses slight. In Vermont, however, 25% injury to the crop caused a loss estimated at 5-10%, and in South Carolina 80% injury probably resulted in a loss of 5%.

The following dates when the disease was first noticed were reported:

June 3	Minnesota	August 22	Pennsylvania
June 13	Colorado	August	South Carolina
July	Wisconsin	October 1	Vermont

Varieties reported resistant were U. S. Government rust resistant seedling in Connecticut, and Palmetto, Washington, and Giant Argenteuil in South Carolina. However, the last-named variety was reported subject to rust in Connecticut.

Other diseases.

Dwarfing and malformation of new shoots, associated with Fusarium sp., was reported from New Jersey. The Fusarium was said to be always present, but it has not been proven to be the cause of the disease.

Stem rot caused by Fusarium sp. was reported from Ramsey County, Minnesota, September 11.

Fusarium sp., causing red streaks on shoots, was reported as slight on 10% of the crop in the Delta section of California.

Anthracnose caused by Colletotrichum sp. was rather severe on Burr's Mammoth in wet places in New Haven County, Connecticut. This was said to be the first report of the appearance of the disease in the state.

BEET (Garden and sugar).

Scab caused by Actinomyces scabies (Thax.) Güssow was reported from Vermont, Connecticut, New Jersey, Pennsylvania, West Virginia, and Minnesota. It caused appreciable loss only in New Jersey, where it was said to be very severe and destructive locally in the northern part of the state.

Crown rot caused by Phoma betae Frank was reported from New Mexico, where it caused a loss estimated at 1%. The Phoma leaf spot and crown rot were reported by collaborators as occurring on sugar beets in Colorado and Idaho, causing slight losses in both states. The disease was also found on specimens received by the Office of Sugar Plant Investigations from the following additional states: Virginia, Wisconsin, Kansas, and California.

Leaf blight caused by Cercospora beticola Sacc. was reported as generally prevalent but causing slight losses in Vermont, New Jersey, South Carolina, Georgia, Ohio, Indiana, Minnesota, Missouri, and Texas. It was local in Connecticut, Kentucky, North Dakota, and Oklahoma. On sugar beets the disease was abundant in Colorado, and in California, where it caused moderate losses. In Indiana, Iowa, and Idaho it occurred locally. It was reported by the Office of Sugar Plant Investigations as having been found on specimens from Virginia and Nebraska also.

Stem rot caused by Sclerotium rolfsii Sacc. was reported from Spaulding County, Georgia.

Rhizoctonia (Corticium vagum solani Burt.) was reported from Snohomish and Wahkiakuh Counties, Washington.

Crown gall caused by Bacterium tumefaciens E. F. S. and Townsend was reported as causing very little damage in Polk County, Wisconsin.

Root-knot (Heterodera radicicola (Greef.) Müll.) was reported from Mississippi and Texas as unimportant, although prevalent in the latter state. It occurred in sugar beets in Colorado, where it caused a loss of less than 1%; and in southern California, where it was severe, according to D. G. Milbrath.

The sugar beet nematode (Heterodera schachtii Schmidt) was reported from Colorado and California. D. G. Milbrath reported that in Southern California it caused heavy losses, reducing the yield in one section of Orange County from 15 tons (the normal yield) to 1.5 tons per acre and the sugar content from 15-16% to 11-12%. Soil infestation in that locality was said to be increasing.

Crop rotation and soil treatment were recommended from Colorado as control measures for both nematodes, although the former method was said to give only fair results, and the latter was commercially impracticable.

Curly top or mosaic, cause not definitely determined, was reported from Dona Ana County, New Mexico. It was reported on sugar beets from Idaho, where it was said to be prevalent, causing a loss estimated at 20%; from Colorado, especially in the Arkansas Valley; from Walla Walla County, Washington; and from the San Joaquin Valley, California, by D. G. Milbrath, where it was unusually severe, causing an almost total loss. It was found also in specimens received by the Office of Sugar Plant Investigations from Utah, and Kansas.

A bacterial heart rot of mangel-wurzels was reported from Pierce County, Washington.

Sugar beets examined at the Office of Sugar Plant Investigations showed the following diseases:

Fusarium spp., Kansas, Michigan, Utah, and Idaho on roots; Colorado on leaves; Virginia on roots and leaves.

Leaf spot caused by Alternaria sp., - Virginia, Michigan, Utah, Colorado, Idaho, and California.

Rheosporangium aphanidermatus Edson - Utah.

Rhizopus nigricans Ehr., - Utah and Idaho.

Diplodia sp., - Colorado.

Penicillium sp., (secondary) - North Carolina, Idaho, Colorado.

Mucor sp., - Utah.

"Purple leaf disease", - a disease of unknown cause reported from Idaho, from Utah; apparently of bacterial nature, but cultures failed to show anything but saprophytic bacteria.

CARROT

Root knot caused by Heterodera radicicola (Greef.) Müll. was reported to be common in South Carolina, injuring a large percentage of the crop.

Leaf spot caused by Cercospora apii Fr. occurred locally in Indiana, but caused no loss.

Rhizoctonia was reported as abundant from Klickitat County, Washington, August 1; and from Porto Rico in the vicinity of San Juan, attacking the foliage only, and causing 70% injury to the crop.

Rot caused by Sclerotium rolfsii Sacc. was reported to be rather abundant locally in Oconee County, South Carolina.

Watery soft rot caused by Sclerotinia libertiana Fckl. was common on the 1918 crop in storage in Tippecanoe County, Indiana.

Soft rot caused by Bacillus carotovorus Jones was reported from Kentucky and Oklahoma.

A *storage rot* caused by *Penicillium* sp. was reported February 22 from Whitman County, Washington.

A *storage rot* caused by *Botrytis* sp. was reported February 22 from Whitman County, Washington.

A *brown rot*, cause not determined, was reported July 14 to be causing severe damage locally in Jasper County, Missouri.

Soft rot, cause unknown, was reported from Long Beach, Mississippi, where in one field less than 5% of the plants were affected. A similar trouble was abundant in Gooding and Twin Falls Counties, Idaho.

CASSAVA or Tapioca (Manihot utilissima)

Root rot caused by *Phytophthora* sp. and *Rhizoctonia solani* occurred in Porto Rico. Only one case was reported.

CELERY

Late blight caused by *Septoria petroselini apii* Br. and Cav.

Late blight seemed to be not so widely distributed as in 1918. It was reported from Massachusetts, Connecticut, New Jersey, Pennsylvania, Florida, Ohio, Indiana, Michigan, Missouri, Arkansas, North Dakota, Colorado, and California. In 1918 it was reported also from New Hampshire, New York, Virginia, South Carolina, Texas, Illinois, Wisconsin, Montana, Utah, and Washington.

The disease was more abundant than usual in Connecticut, although appearing late in the season; while in Ohio it was more generally distributed but caused less damage than usual. In Florida, Ohio, Indiana, Michigan, Missouri, Arkansas, and North Dakota the disease was apparently not especially important. In Massachusetts and New Jersey it was reported to be severe and generally prevalent, in the former state causing losses often amounting to 50% in unsprayed fields. In Pennsylvania the loss was estimated at 5%. In Colorado the disease was common, particularly in the vicinity of Denver, causing probably 25% injury to the crop and 2% loss. The largest losses due to late blight were reported from California by D. G. Milbrath. In the southern part of that state the loss was estimated at 8%, although continuous spraying was practiced, and in the Watsonville section the crop was considered a failure and shipments abandoned because of a 40% loss.

Late blight was found by inspectors of the Bureau of Markets in celery shipped to eastern and middle-western markets from California, Colorado, Florida, Michigan, and New York, as shown in Table 84.

Dates when the disease was first noticed were reported by collaborators as follows:

August 6 .... Missouri
September 1 ...... Colorado
September 6 .... Indiana
September .... Pennsylvania

Excellent results from the use of Bordeaux mixture in controlling the disease were reported from Massachusetts and New Jersey. In Pennsylvania it was said that the disease was much more severe in fields in which crop rotation was not practiced.

Table 84. Prevalence of late blight of celery in cars examined by inspectors of the Bureau of Markets, 1919.

Origin of shipment	No. of cars	Date inspected	% affected plants	Remarks as to severity of late blight.
California	1	Apr. 1	20-25	Damage beginning to affect tops of branches.
	1	Apr. 8	-	In two top layers.
	1	"	-	Decay in top leaves general, consisting of bad late blight and soft rot.
Colorado	1	Sept. 25	35	
Florida	1	May 9	Slight-100	All top leaves in upper crates badly affected, 60% in middle layers and a mere sprinkling in lower part.
	1	May 9-10	100	Entire stock badly spotted with late blight.
	1	May 23	Slight	Slight decay, a few scattering leaves showed decay following late blight.
Michigan	1	Oct. 31	-	Slimy soft rot following late blight in leaves and upper branches of all stock; into 1-2 main branches in about half of stalks.
	1	Nov. 4	-	Decay in leaves and top branches throughout load.
New York	2	Nov. 3	-	Slimy soft rot following late blight throughout load in both cars.

Early blight caused by *Cercospora apii* Fr.

Early blight was reported from most of the northeastern states, and from South Carolina, Florida, Missouri, and California. In most states it occurred in about the usual amounts, but in Massachusetts, although abundant in certain localities, it was not so generally distributed as in 1918, and in Ohio also it was said to be less prevalent. Pennsylvania, on the other hand, reported more than in 1918.

Injury from early blight seemed to be local for the most part and losses were not particularly important in most cases. In Vermont, however, the loss was estimated at 2-5%, and in Pennsylvania at 2%. In southern California the disease was especially severe and caused a loss of 10%, according to D. G. Milbrath.

Examinations made by inspectors of the Bureau of Markets at Chicago and other middle-western cities showed varying amounts of early blight on celery from Florida, Louisiana, and New York. The findings in individual cars are given in the following table:

Table 85. Prevalence of early blight of celery in cars examined by inspectors of the Bureau of Markets, 1919.

State	Date	% affected plants in individual cars	Abundance of early blight lesions
Florida	May 9	100	Numerous.
	" -	-	"
	" -	-	Few, scattered.
	" 14	100	Many.
	" 15	-	Few, scattered (25-75% secondary decay).
	" 17	About 100	Slight.
	June 6	" 40	--
	June 25	-	Some
	" 25	-	"
Louisiana	June 20	Probably 100	Very numerous.
	" 26	100	Heavy infection.
New York	Nov. 7	About 100	8-10% affected leaves.

Dates when the disease was first noticed were reported by collaborators as follows:

July 14............. Missouri   October 1 .... Vermont
July 22............. Indiana   October 24......... Pennsylvania

Spraying with Bordeaux mixture was said to give excellent results in controlling the disease in New Jersey.

Foot rot caused by Sclerotinia libertiana Fckl.

This disease was reported as occurring in the field from New Jersey and from Florida. In New Jersey it was said to be only occasionally found; but in Florida it was abundant, although probably not doing so much damage as in the preceding year.

Watery soft rot, as the disease is called in the market, was prevalent throughout the year in car lots of celery shipped from the following states: California, 14 cars, loss ranging from a trace to severe, mostly considerable;

Colorado, 2 cars, average loss slight; Florida, 36 cars, loss ranging from a trace to very severe, average probably rather severe; Louisiana, 1 car with considerable loss; Michigan, 6 cars, considerable; New York, 11 cars, loss slight to considerable, mostly considerable; Utah, 1 car, loss considerable.

The damage in individual cars was sometimes particularly severe. Some of the heaviest losses were reported as follows: In one car of California celery, "All stalks in 14 crates in top of load, 25-30% of stalks in upper layer, 20-35% of stalks in second layer, 15-20% of stalks in bottom tier affecting 2 to 6 branches. Decay in tops general throughout load consisting of late blight and watery soft rot."

In Florida celery, Car No. 1 showed "lower tiers 5-10% bad decay; next to top tier 75%; top tier 90-95%, all of this bad decay." Car No. 2 showed "100% of stalks in top tiers of crates, 75% in second tier, and 50% in rest of tiers with watery soft rot, in lower part of tiers slight, in upper part mostly complete decay."

In one car of New York celery, "Most stalks in all crates showed decay. From one-fourth to three-fourths of the bunches were almost completely decayed, due to watery soft rot."

As may be seen from the reports quoted above, the decay was usually most severe in the upper tiers. It was also often mentioned as being bad near the doorways.

Other diseases.

A bacterial crown and heart rot was said to be very severe and destructive in some localities in New Jersey, and was also reported from Indiana, where it was prevented from becoming serious by unfavorable dry weather.

A bacterial leaf spot was reported from Indiana, where it was said to be common, and from Michigan. In the latter state it was observed by R. Nelson as "Taking the form of petiole lesions, causing great loss in fields about Kalamazoo since the blighted portions rot badly. Growers assign trouble to frost."

Black heart in 1919 was reported only from Florida. G. K. K. Link, who visited the Sanford, Bradentown, and Manatee districts in the early part of March, reported as follows:

> "More serious from a market point of view than the early blight is the very general appearance of heart rot which was induced prematurely by the heavy rains. Usually heart rot is found later in the season in Golden Heart celery...... It is least marked on the muck lands near Bradentown. The dead tissue is at first light brown and quite watery in appearance, much as tip burn affected lettuce appears. Very soon bacteria attack the killed tissues and cause a black rot. I saw acres of fields in which the hearts had rotted away completely."

"Stunt" or yellows was reported to the Survey in 1919 for the first time. The disease occurred in Indiana and Michigan. In Indiana, where it was first reported July 8, it caused 10% injury in certain cases. In this state the variety Golden Self Blanching was said to be susceptible, while Easy Bleaching and all late varieties were found to be resistant. In Michigan the disease was found July 1 at Mason, where seed-bed infection led to severe injury of the entire celery planting.

Root rot caused by Phoma apiicola Speg. was found in Michigan. C. W. Bennett reported that this root rot had in several instances done considerable damage to celery in the past few years. (Phytopath. 10: 67, 1920.)

Rhizoctonia was found in negligible amounts in Connecticut, Ohio, and Colorado.

Root knot caused by Heterodera radicicola (Greef.) Müll. was reported by D. G. Milbrath as severe in southern California, causing a loss of 2%.

So-called rust, supposedly non-parasitic, was reported November 10 from two farms in Indiana County, Pennsylvania, where losses of 50% and 75% on the variety White Plume occurred.

A condition spoken of as "heart blasting", cause unknown, was reported from California by D. G. Milbrath, who described it as affecting the heart, leaving only an outer circle of leaves. Five per cent occurred in the Delta region, and two per cent in Southern California.

EGGPLANT

Fruit rot caused by Phomopsis vexans (Sacc. & Syd.) Harter.

In 1919 fruit rot was reported from fewer states than in 1918. It was reported to the Survey from South Carolina and California for the first time, and from New Jersey, Florida, Ohio, Indiana, Iowa, Missouri, Louisiana, and Oklahoma.

In Ohio, Louisiana, and Missouri the disease was reported as causing slight damage. In South Carolina, Indiana, and Iowa it was said to be abundant locally, particularly in the latter state, where, in two cases, the crop was almost completely ruined. In New Jersey it was reported as abundant and in some instances very destructive. In Florida and in California the heaviest losses from fruit rot apparently occurred. As much as 90% of the crop was said to be injured in some localities in the former state. G. K. K. Link reported in March that in the vicinity of Fort Myers, one of the largest eggplant growing sections of the state, whole fields were completely ruined by the disease, and losses were so heavy that growers were about to give up the culture of eggplant. Reports of inspectors of the Bureau of Markets showed fruit rot also severe on Florida eggplant in transportation (7 cars). In California D. G. Milbrath reported that the disease caused 60% loss in San Diego County, the only section of the state where eggplant was grown on a commercial scale.

No variety was reported as being either especially resistant or susceptible. The use of disease-free seed, crop rotation, and the disease-free soil in seed beds was recommended in Florida as a means of controlling fruit rot.

Bacterial wilt caused by Bacterium solanacearum E. F. S.

In 1919 bacterial wilt was reported only from South Carolina and from Florida. In both states it was local in distribution and was not reported as particularly important. In Florida crop rotation was apparently successful in controlling the disease.

Verticillium wilt caused by Verticillium sp.

This wilt was reported as local in South Carolina, and as generally prevalent and destructive in both New Jersey and Georgia. In the latter state it was said to cause damage ranging up to 50% of the crop in some cases.

Other diseases.

Root knot caused by Heterodera radicicola (Greef.) Müll. was reported to be generally prevalent in South Carolina, where 45% injury to the crop resulted in a loss estimated at 3%; and in Florida, where it was common on the lighter soils. Crop rotation was recommended in the latter state as a method of controlling the disease.

Southern blight caused by Sclerotium rolfsii Sacc. was reported as general in Georgia, causing injury ranging from 1-50%.

Fusarium wilt caused by Fusarium sp. was reported from Florida, where it was said to be local and unimportant.

Anthracnose caused by Gloeosporium melongenae Ell. & Hal. was reported as causing slight loss, 1% or less, in Delaware.

Rhizoctonia was reported from Louisiana as causing slight injury in seed beds.

Mosaic was reported by C. D. Sherbakoff from Palm Beach County, Florida.

A wilt, cause not determined, was said to be serious in market garden sections around Indianapolis, causing 50% injury. An undetermined wilt was also reported from Missouri, where it was not important.

GARLIC

Botrytis sp. was reported by D. G. Milbrath from Alameda County, California, as slight on garlic in the field, but increasing rapidly in storage.

GINSENG

Blight caused by Alternaria panax Whetzel was reported from Iowa (common, estimated loss severe), and from Minnesota.

Rhizoctonia sp. was reported from Washington (King County).

HORSE BEAN (Vicia faba)

Rust, caused by Uromyces sp., was reported from Louisiana as common, affecting a majority of the plants and causing a considerable loss to the crop as a whole.

Sun scald was reported from Northern Idaho.

LETTUCE

Drop caused by Sclerotinia libertiana Fckl.

Drop again seemed to be the most serious disease of lettuce, although fewer reports were received than in 1918. It was reported from most of the eastern and southern states and from California. Traces were reported from North Carolina and Mississippi, and it was said to cause slight losses in South Carolina, Michigan, Alabama, and Colorado. In the other states it caused considerable injury and loss, particularly in Pennsylvania (in the vicinity of Philadelphia), Florida, and California in the field; and in Massachusetts, New Jersey and Indiana in greenhouses and cold frames.

Considerable loss was caused by this disease in the markets, where it is known as watery soft rot. These losses as estimated by inspectors of the Bureau of Markets are shown in the following table:

Table 86. Losses caused by watery soft rot of lettuce as shown by examination of cars at destination by inspectors of the Bureau of Markets.

Origin of shipment	No. of cars with decay	Average percentage of decay	Range of percentage of decay		Remarks as to seriousness of decay.
			No. cars	Percent	
California	5	24	3	5-15	Slight decay.
			2	35-60	Bad decay.
Florida	10	59	2	12-20	Slight decay.
			4	42-63	Bad decay.
			4	75-100	Worthless.
New York	2	58	1	30	
			1	85	Bad decay.
Pennsylvania	1	22	1	5-40	
South Carolina	1	75	1	75	Following tip burn.
Texas	4	74	1	45-100	Bad decay.
Unknown	1	-	1		Bad decay, affecting 3-20%.

Gray mold rot caused by Botrytis cinerea Pers.

Gray mold rot was reported from Massachusetts, New York, Pennsylvania, North Carolina, Ohio, Indiana, Michigan, Wisconsin, Iowa, Louisiana, Texas, Oklahoma, Arkansas, and Washington. In 1918 it was reported only from Massachusetts, New York, Pennsylvania, Arkansas, and Ohio.

The disease was said to be unimportant or occasional in New York, Ohio, Michigan, Wisconsin, Louisiana, and Oklahoma. It was reported as very abundant in greenhouses in Massachusetts, probably favored by cloudy weather, and in

Indiana, where it was said to be the most serious greenhouse disease of lettuce. In Pennsylvania, although reported to be less abundant than in 1918, it was generally prevalent wherever lettuce was grown, causing a loss estimated at 2-3%. In Texas it was said to be prevalent, perhaps because of wet weather, causing a loss estimated at about 1%. From North Carolina it was reported by R. A. Jehle as follows:

> "I spent Monday in New Hanover County, going in response to a telegram from the county agent. He took me to a number of fields and I found head rot in every field visited. Losses were from one-third to over-one-half of crop. The county agent estimated that the loss in the county will average about one-third of crop. The trouble seems to be caused by Botrytis cinerea which I found fruiting in many beds. The disease begins at the tips of the leaves, causing them to turn yellow, then brown, and finally a slimy rot follows. Heads may look healthy but when opened the tips of inner leaves may be infected. As prevalent on one variety as another and found on plants grown on different types of soil."

Downy mildew caused by Bremia lactucae Regel.

Downy mildew was reported as causing slight losses, usually in greenhouse, in most of the northeastern states. In Ohio and in Indiana it was said to be generally severe in early spring, in the latter state causing 80% injury to lettuce in some greenhouses. Traces were reported from Iowa and North Dakota. The disease was also found in Texas, where it was said to be rather abundant in the field in some sections.

Reduction in the amount of water given, good ventilation, and three applications of Bordeaux mixture were said to be effective in controlling the disease in greenhouses in Iowa.

Stem rot and rosette caused by Rhizoctonia sp.

Rhizoctonia occurred in the northeastern states, in Louisiana, Texas, and Oklahoma, in North Dakota, and in Washington. In most cases the losses caused by it were said to be slight or very slight. In some states, however, it did considerable damage. In New York, where it was said to be more severe in the western part of the state, the losses in greenhouse lettuce were estimated at 10%, and in the field as ranging from 5-50%. In Ohio it was reported as more severe on poorly drained clay than on other types of soil. In Pennsylvania it was said to be very severe, as usual, causing losses estimated at from 3-5%. A loss of 1% was reported from Texas.

Control measures were reported only from Ohio, where steam sterilization of soil in greenhouses was said to give good results.

Tip burn (non-parasitic)

In 1919 tip burn was reported from South Carolina, Florida, Louisiana, Texas, and California. Only one of these states, Louisiana, reported the disease as present in 1918, when it was also found in Massachusetts and Pennsylvania.

In Texas the disease was reported by L. R. Hesler as causing moderate damage and slight loss in one large field near Harlingen. In South Carolina, where it was common near the coast, it was said to cause 20% injury, resulting in a loss estimated at 2%. In Florida it was reported by G. K. K. Link as very abundant, causing fields to be abandoned in one locality. In Louisiana, according to L. R. Hesler, it was the most prevalent lettuce trouble in the region south of New Orleans. In California it was reported by D. G. Milbrath to be common in all sections.

The disease was also found affecting lettuce in transportation from some of these states and from several additional states. Losses caused by it are shown in the following table:

Table 87. Losses caused by tip burn of lettuce as shown by examination of cars at destination by inspectors of the Bureau of Markets.

Origin of shipment	No. of cars with tip burn	Average percentage of tip burn	Range of percentage of tip burn		Remarks as to seriousness of disease.
			No. cars	Percent	
California	11	44	4	2-9	Slight decay.
			3	32-50	
			4	65-100	Bad decay.
Illinois	1	-	1		Heavy tip burn.
Minnesota	1	30	1	20-40	Accompanied by slimy soft rot.
New York	6	32	2	2-10	Slight decay.
			4	50	Followed by slimy soft rot.
North Carolina	1	-			Outer leaves of many heads.
South Carolina	1	100	1	100	All heads affected.
Texas	2	47	1	20	Affecting several outer leaves.
			1	75	Bad decay.

Other diseases.

Wilt caused by *Fusarium* sp. was reported from Ohio.

Leaf spot caused by *Alternaria* sp. was reported from Louisiana.

Leaf spot caused by *Cercospora* sp. was reported from Louisiana as causing slight loss.

A leaf spot due perhaps to *Ramularia* sp. was reported by D. G. Milbrath as general in the vicinity of San Francisco.

Slimy soft rot caused by bacteria of the *Bacillus carotovorus* type was reported injuring the crop in the field in Minnesota, Louisiana, and California. In Louisiana it was associated with tip burn and caused a loss estimated at 5-10%. This combination of injuries was said to constitute probably the most serious lettuce trouble in the state. Slimy soft rot was also very common and caused heavy losses in shipments of lettuce to various markets.

Bacterial rots caused by Bacterium marginale and Bacterium vitians were reported from New Jersey. Bacterial blight due to the latter organism was reported as common in the coast region of South Carolina, causing a loss of 5%.

Root knot due to Heterodera radicicola (Greef.) Müll. was reported from South Carolina as common, causing a loss estimated at 5%, and from Ohio as more prevalent than usual.

Bacterial leaf spots were reported from Florida, Ohio, and Indiana.

Internal browning, cause unknown, was reported by D. G. Milbrath as severe in the Imperial Valley, California, causing the abandonment of several fields. He describes the disease as follows:

> "It appears to be a definite disease causing internal browning from the crown (inclusive) upward. The outer leaves of the head are apparently sound with the exception of marginal browning, readily judged the result of dryness or injury by soil contact. The second cycle of leaves usually is normal. Under this cycle the browning increases into the heart."

LIMA BEAN

Downy mildew caused by Phytophthora phaseoli Thax.

Downy mildew was reported from Connecticut, New Jersey, Delaware, Pennsylvania, and California. In the first four states mentioned the disease was considerably more abundant than usual. In a number of localities high losses were recorded. For instance, one large grower in Connecticut reported 75% of his crop destroyed, and in Pennsylvania 75% of the lima beans at Bustleton were affected. The weather conditions were apparently very favorable for the disease so that it spread rapidly and was destructive to susceptible varieties.

Other diseases.

Pod blight caused by Diaporthe phaseolorum (C. & E.) Sacc. was reported from Connecticut (scarce), New Jersey (prevalent but not destructive in the southern part of the state), Alabama (general), and Louisiana (general, at least in St. Landry Parish).

Rust caused by Uromyces appendiculatus (Pers.) Lev., was reported by E. V. Hollis from Louisiana where he found a slight amount locally; and by D. G. Milbrath from California, where it was present but not causing very high losses, although the variety Lady Washington was rather severely affected in the southern part of the state. This disease on lima bean was thought not to be a very common thing in Louisiana.

Bacterial blight, thought to be caused by Bacterium phaseoli E. F. S. was reported from Pennsylvania, South Carolina, and Louisiana. In Pennsylvania C. R. Orton reported as follows: "Brown fibro-vascular bundles, plants typically wilted. Only seen on the pole limas, bush limas in adjacent rows not affected. Have not seen this disease before in the state." It was first noticed by Orton September 21 in Lycoming County.

In South Carolina the disease was said to be common and generally destructive, injuring a rather large proportion of the crop.

Mosaic (cause undetermined) was reported by D. G. Milbrath from California as severe in parts of Los Angeles County.

Root rots, caused by Fusarium and Rhizoctonia spp., were troublesome in Orange, Los Angeles, and San Diego Counties, California. The lima bean crop in Southern California was short last year. While much of this was attributed to lack of moisture, it was thought by Milbrath that Fusarium and Rhizoctonia were responsible for a large amount of the reduction in yield by attacking the roots and stems.

Root knot caused by Heterodera radicicola (Greef.) Müll. was severe in Los Angeles and Orange Counties in California, where 10% loss occurred, according to estimates of D. G. Milbrath.

Powdery mildew caused by Erysiphe polygoni DC. caused a 2% loss along the coast in California.

OKRA

Verticillium wilt caused by Verticillium albo-atrum R. & B. was reported as abundant in one locality in New Jersey.

Root rot caused by Ozonium omnivorum Shear was prevalent in Texas, causing a loss estimated at 4%.

Root knot caused by Heterodera radicicola (Greef.) Müll. was reported as causing 5% loss in South Carolina, and slight loss in Louisiana.

PARSNIP

Leaf blight caused by Cercospora apii pastinaceae occurred in Connecticut, where it was said to be more prominent than usual, although not serious.

PEA

Blight caused by Mycosphaerella pinodes Berk. & Blox.
= Ascochyta pisi Lib.

In 1919 this blight was reported from New Jersey, Delaware, Pennsylvania, Maryland, Georgia, Ohio, Indiana, Wisconsin, Minnesota, Mississippi, Louisiana, Texas, Arkansas, and California. The disease was apparently not serious in most states. In Maryland, however, it reduced the crop considerably, and in California it was reported very severe in the region around San Francisco Bay, particularly on early peas. In Wisconsin there was less blight than usual. The campaign conducted in that state since 1912 on the value of crop rotation, clean seed, and cultivation was thought to be largely responsible.

Bacterial blight caused by Bacterium pisi Sackett.

Reported from Colorado (scarce, slight injury) and Michigan (common with certain lots of seed, loss slight).

Bacterial blights (causes uncertain).

Blights of a bacterial nature were reported from Delaware, Maryland, District of Columbia, Mississippi, Louisiana, Indiana, and Wisconsin. In Delaware the trouble was ascribed to Bacterium lathyri by Manns. The disease was the cause of large losses in some of the canning sections of the East. The following report on the situation in Delaware is supplied by T. F. Manns:

Pea situation in Delaware

by

T. F. Manns.

> The almost general collapse of peas has caused much alarm among farmers and canners as to the future of the pea crop. From what all thought to be an ideal pea season, that is, cool, wet weather, there has resulted a crop close to a failure. May, with a rainfall of nearly five inches, proved a disastrous month for the crop.
>
> Opinions among the more successful growers vary widely. Many hold that the unusually early and severe green lice attack was responsible, with wind and sand storms contributing causes; others that rains were excessive and too frequent and aside from the earliness of the lice attack and the wind and sand injury, the season was somehow or somewhat responsible. Some have blamed the fertilizer and others, having their first experience with agricultural salt, felt this new venture was their downfall.
>
> After a careful survey of the whole district, it is estimated that the crop will not reach 25% of a fair yield. Many fields will not be cut.
>
> Certain specific pea diseases are responsible for the failure on the well prepared and manured fields. The soils in many fields have become pea sick. One of these troubles; namely, a bacterial disease, has been greatly aggravated and spread by the green lice as carriers of the trouble, after their mouth parts became infected. The disease starts as a sick soil condition and spreads by rain spattering the germs on the plants. Severe winds and blowing sand have been contributing factors. The many wet days and nearly five inches of rainfall in May have not only assisted in spreading disease but on the weaker soils have leached out so much of the nitrogen as to cause very weak growth.
>
> In the survey of the pea district made by the Department of Plant Pathology, these troubles were common throughout the district. Some fine fields were found and the history of every good field showed that peas had not been grown on the land from four to six, eight, and ten years, and even in some cases never before in the memory of the owner. The fact that many good fields were found would set aside the possi-

bility that the season was entirely abnormal, or that wind and rains were entirely responsible, for all received the heavy and frequent May rains and other seasonal conditions; and many of the good fields were exposed to strong winds and sand movement. Also practically all fields had an early and quite general distribution of lice. The non-sick fields continued normal and made rapid growth, quickly outgrowing the lice. This was not the case of the sick lands; the lice early became contaminated with the disease, and abundantly infected the plants at the base of the stem. Wind and rains were contributing factors on sick soils. On some new fields, with weak soils upon which 400 to 500 pounds of 2-10 fertilizer only were used, collapse from starvation was the chief factor. However, growers have learned that peas cannot be grown on run down lands by use of low grade fertilizers only, Unless land is in good condition manure must be used. Inoculation on all good fields was well supplied though some growers claimed not to have used soil or cultures in getting such good results.

In many fields examined, none in peas the second season in succession showed good results and those fields which were in for a third or fourth season were practically failures, regardless of how well the land was prepared, fertilized, manured, or when planted. On such sick fields early seeding was equally disastrous with late seeding. On well rotated and properly fed lands with peas this season for the first time in four to six years, they had in nearly every case a good crop, with little sickness showing, though enough was present to indicate rotation should be practiced.

Root rots caused by various organisms.

The pea root rot and blight problem is a complicated one and is serious at least in some sections of the country, especially in certain canning sections. Apparently there are a number of parasites concerned. The bacterial troubles just described are factors, Fusarium is believed to be important, and Rhizoctonia, Pythium and possibly other fungi may be involved.

Root rots thought to be caused by Fusaria were reported as local in Michigan, Mississippi, and California (Alameda County), and as apparently less general and less severe than usual in Ohio. In New York root rot was said to be as a rule not serious in larger fields, but very common in gardens, where crop rotation was not usually practiced. Georgia, Alabama, and Colorado also reported it present in home gardens. In Pennsylvania Fusarium was said to be serious, but probably confused with Rhizoctonia, which was also abundant. In Maryland it was reported to be increasing in prevalence and severity each year, causing much reduced yields. The disease was abundant and destructive in Massachusetts, New Jersey, and Delaware; in Wisconsin, where the injury due to it was difficult to estimate, being combined with hot weather injury; and in Louisiana, where it killed the plants before they commenced bearing.

The following special reports from Maine and Maryland are of especial interest:

> Maine: (W. J. Morse) "We have had numerous complaints of a basal stem-rot of pea this season, but not as many as in certain wet seasons. We have no conclusive evidence but think this is, as a rule, caused by a Fusarium. From conversation with

Temple of Maryland, Cook of New Jersey, and Richards of Wisconsin at the recent meeting on Long Island I am inclined to think that our trouble is about the same as they have there."

Maryland: (C. E. Temple) "Becoming more serious each year. The disease has spread throughout the canning section and into almost all gardens. It does not cause total loss but a much reduced yield. First year's work in selecting wilt-resistant plants has been very promising of results. A few hundred plants out of several thousand have stood the test two years in succession."

Rhizoctonia root rot was reported from Pennsylvania, where it was serious in a number of instances, and from Washington.

Pythium root rot occurred in Connecticut, Illinois, Michigan, and Wisconsin. Regarding its occurrence in the former state G. P. Clinton stated;

> "Unusual and serious trouble this year, saw two fields with less than one-half of a crop and several complaints from over the state have been received. Plants showed red root rot but could not always find Pythium, think this becomes obscured by the other things."

In Wisconsin, Michigan, and Illinois Pythium seemed to be the chief causal factor in the prevalent pea root rot trouble of those states according to F. R. Jones (Phytopath. 10; 67, 1920.)

Septoria blight caused by Septoria pisi West.

Septoria blight was reported from Ohio, Wisconsin, Texas, and California. It was not important except in California where it was severe in Alameda and Santa Clara Counties, according to D. G. Milbrath.

Mildew caused by Erysiphe polygoni DC.

Mildew was found in Vermont, New York, Pennsylvania, Ohio, Wisconsin, Minnesota, Georgia, Alabama, Louisiana, Texas, Oklahoma, Colorado, Idaho, and California. Although common in many states, it in most cases appeared too late to cause much injury to the crop. In Colorado and California, (San Diego County) however, it was locally very severe, causing 100% injury in the former state. According to D. G. Milbrath, sulphuring was practiced in California to control the disease.

Other diseases and injuries, 1919

Pod rot caused by Phytophthora terrestria Sherb. was reported by Matz from Porto Rico as having been found in 1919 for the first time. The injury caused was small.

Downy mildew, caused by Peronospora viciae Berk. was local in Wisconsin, loss trace.

Rust caused by Uromyces pisi (Pers.) De Bary was reported from North Dakota.

Root knot caused by Heterodera radicicola (Greef.) Müll. was reported by D. G. Milbrath as present in the Imperial Valley, California.

Leaf scorch was reported from Livingston County, New York.

Frost injury was reported from Pierce and Whitman Counties, Washington.

PEANUT

Leaf spot caused by Cercospora personata (B. & C.) E. was generally prevalent and caused considerable injury and loss in South Carolina, Georgia, Florida, Alabama, Tennessee, and Arkansas. The damage to the crop in South Carolina was about 90%, and the loss was estimated at 15%. As high as 75% of the crop was injured in Georgia, resulting in a probable loss of 5-10%. In Florida the loss was reported as probably 2-3%. In Tennessee a loss estimated at 10,000 bushels resulted from 5% injury. No estimates of losses due to this disease were made in Alabama and Arkansas, but it was reported as common and serious in both states. In the latter state it was said to be about the only serious trouble observed.

Dates when the disease was first noticed were reported as follows; South Carolina, June; Florida, July; Georgia, July 1; Tennessee, July 15.

J. A. McClintock reported that in Georgia the disease was "especially bad on Spanish peanuts, many of the leaves having fallen before the normal time for harvesting the crop."

Root rot caused by Sclerotium rolfsii Sacc. was local in South Carolina and Tennessee, general in Georgia, where it caused a loss estimated at 5%, and present in Florida, Alabama, Texas, and Hawaii.

Root rot caused by Ozonium omnivorum Shear was prevlaent in Texas, causing a loss estimated at 1%.

A wilt or stem rot suspected as being caused by Rhizoctonia sp. was reported from Greenville County, Virginia.

PEPPER

Bacterial wilt caused by Bacterium solanacearum E. F. S. occurred in Texas, but was unimportant.

Root rot caused by Sclerotium rolfsii Sacc. was general in Georgia, causing as high as 50% injury to the crop in some cases and a loss estimated at 5%.

Alternaria sp. causing leaf spot, mold, and fruit rot, occurred in New Jersey (reported as Macrosporium sp.), Delaware, Georgia, Kansas, and New Mexico. It was apparently not very important in any of these states, although rather common in New Jersey and Kansas. In New Mexico the disease caused a blight of Chile peppers, girdling and killing the stems, and also attacking the fruits, resulting in a loss estimated at 3%.

Leaf spot due to Cercospora sp. was common in Florida where it caused considerable trouble, particularly in the late fall and winter crop. Spraying with Bordeaux mixture was not generally practiced and when used was not always successful in controlling the disease.

A wilt apparently caused by Fusarium sp. caused a loss estimated at 5% in Orange County, California, according to D. G. Milbrath. It was found also in Tennessee, where it was unimportant.

Fusarium wilt caused by Fusarium annuum was reported by L. H. Leonian as serious on Chile pepper in New Mexico. (See also New Mexico Agr. Exp. Sta. Bul. 121 : 1-32, 1919). It appeared in early July and caused losses varying from 10-90% of the crop. It was said to be "confined to wet fields and stimulated by over-irrigation and lack of drainage. If planted on well drained and drier soils, the plants will remain free from disease."

Anthracnose caused by Gloeosporium piperatum E. & E. was reported from Delaware (not common), Alabama (common), and Georgia (general; with Colletotrichum sp. and Macrosporium sp. causing a loss estimated at 25%.)

Anthracnose caused by Colletotrichum nigrum E. & H. was common in New Jersey, and occurred also in Georgia.

Leaf spot caused by Phyllosticta sp. was reported from Alabama.

Mosaic, cause unknown, occurred in New Jersey (common but apparently of little importance), Indiana (local, not serious, causing no loss), Georgia (estimated loss 1%), and Florida (very serious locally, more common than before).

Root knot caused by Heterodera radicicola (Greef.) Müll. was found on peppers infected with mosaic, in the region of Ft. Myers, Florida; and on Chile peppers in Dona Ana County, New Mexico, where it caused a loss of 5%.

A fruit rot, cause undetermined, was reported by C. H. Philpott as causing slight damage locally in Missouri.

Spotting, of unknown cause, was reported in March from Florida, in the vicinity of Ft. Myers, by G. K. K. Link, as follows:

> "Most of the pepper fields are a sorry sight and have not produced a crop since November. Such fruit as is produced is gnarly, rough and small.... Some of the fruit produced in diseased fields is spotted, but in general the disease is manifested by a dwarfing of the plants, a spotting of the stems and leaves and a dropping of the foliage. The cause is not known and the disease has not been named."

Leaf fall, cause not known, resulted in heavy losses in New Jersey.

Crinkled leaf, thought to be due to soil conditions, was locally present in Florida.

Sun scald was reported as common in New Jersey, Indiana, and California.

RHUBARB

Leaf spot caused by Alternaria sp. occurred in Ramsey County, Minnesota.

Anthracnose caused by Colletotrichum erumpens was reported to be general and severe in Philadelphia County, Pennsylvania, appearing late in the season. The disease also occurred in Illinois.

Leaf spot caused by Ascochyta rhei E. & E. was found in Indiana wherever rhubarb was grown.

Leaf spot caused by Phyllosticta sp. was reported from Pennsylvania, where it was generally prevalent, although the estimated loss was slight; from North Dakota, where it was local and unimportant; and from Missouri, where it was common and caused losses ranging from slight to severe.

A bacterial crown rot was local in Missouri. In one instance it was said that three attempts had been made to grow rhubarb, but were unsuccessful because of this disease. It was found on the varieties Linneus and Victoria, the latter being the more resistant, according to the grower.

SALSIFY

White rust caused by Albugo tragopogonis(DC) Gray was common in Iowa, where it was most prevalent in the northern half of the state. The injury caused was reported as a trace. The disease was also reported from Whitman County, Washington.

SPINACH

Blight (cause undetermined).

Blight or mosaic was reported from New Jersey, Ohio, Texas, and California. It was serious wherever found. In New Jersey it was said to be complicated with attacks of aphids. It was reported that in Ohio the fall crop of spinach was destroyed by what was thought to be this disease. It appeared shortly after germination and progressed very rapidly, affecting at the same time and with equal severity fields separated in some cases by 30 miles. Some of these fields had produced good crops in the spring. Aphids were present but not in large numbers. In Texas the disease was especially severe in the vicinity of Austin according to L. R. Hesler, who visited the state in March. In this region about 3000 acres are grown. An average of probably one-third of the crop was affected and from 5-10% of the plants killed, causing a reduction in yield roughly estimated at 15%. In one field the reduction was 2000-6000 baskets. At the time the fields were examined no aphids were found, although apparently some had been present previously. The disease was found on spinach grown on soil which had never been planted to that crop before. It was found that the fertility or type of soil, or the use of fertilizers had nothing to do with the distribution of blight. In one case the variety (?) Viroflay seemed to be more susceptible than Bloomsdale. The disease was also found in the Rio Grande Valley in the vicinity of Mercedes, but not so generally as at Austin. In California D. G. Milbrath reported that a slight trace was present in most fields in the Imperial Valley and that it was severe in Los Angeles County.

A disease reported as blight caused by Fusarium sp. was found in Idaho, where it was said to be severe in gardens at Moscow, killing 75% of the plants.

Downy mildew caused by Peronospora effusa Rabenh.

In 1919 downy mildew was reported from Ohio, Texas, and California. In Texas it was prevalent and severe. L. R. Hesler reported that in one case the variety Bloomsdale (curly) was most affected. It was severe also in California wherever spinach was grown. In the Coachella Valley the loss was estimated at 15%, and in the Imperial Valley it was severe. D. G. Milbrath thinks that much of the disease could be avoided by more careful regulation of the irrigation water.

Anthracnose caused by Colletotrichum spinaciae E. & H.

Anthracnose was reported by L. R. Hesler from Louisiana and Texas. In Louisiana it was general but did little damage. In Texas it attacked the older plants and those affected by blight.

Other diseases.

Damping-off, caused by Pythium debaryanum Hesse, was reported from Connecticut as much more prevalent than usual, causing a moderate amount of injury.

Leaf spot caused by Heterosporium variabile Cooke was reported from Green County, Missouri, where it caused 50% injury to the crop, and was said to be more severe on the fall-sown crop; from the vicinity of Austin, Texas, where it was general but not serious; and from California, where it was very severe in the Sacramento Valley, according to D. G. Milbrath.

Black mold caused by Cladosporium macrocarpum Preuss. was reported by L. R. Hesler as very abundant in the vicinity of Mercedes, Texas, causing damage ranging from moderate to severe. In most cases it followed downy mildew and anthracnose.

Rust, thought to have been caused by Puccinia subnitens, was reported from Washington.

Frost injury was reported from Texas and Washington.

SWISS CHARD

Leaf spot caused by Cercospora beticola Sacc. was reported from Kentucky, where it caused 2% injury in the fields at the Experiment Station; from Missouri, where it caused considerable damage locally; and from the District of Columbia.

TARO (Colocasia spp.)

Rot of corms caused by Pythium debaryanum Hesse was reported by C. W. Carpenter from Hawaii, where it was said to be the most common and destructive rot of this crop. Crop rotation and applications of lime were suggested as control measures, although further experimental work on the subject is needed.

Phytophthora colacasiae Rac. (?) occurred in Oahu, Molokai, and Hawaii on taro leaves.

Rot caused by Sclerotium rolfsii Sacc. was reported from Hawaii on corms in storage.

TOBACCO

Black root rot caused by Thielavia basicola (B. & Br.) Zopf. was reported from Connecticut, Georgia, Ohio, and Wisconsin. In Connecticut it occurred in the usual amounts, and caused moderate damage. In Georgia it was generally prevalent, causing 100% injury in some cases, and a loss estimated at 5%. In Wisconsin, where it was said to be ordinarily the most serious disease of tobacco, high soil temperatures in the latter part of the summer prevented it from doing as much injury as usual. However, the disease made enough headway during the cooler weather in June and on badly infested soils to cause considerable loss. In Ohio there was very much less than usual, and the loss was negligible, because of hot weather.

Controlling the disease by steaming the plant beds was said to give good results in Ohio, although in 1918 this method, used in alternate years, had been reported from the same state as unsatisfactory.

Mosaic (cause undetermined) was reported as locally present in Virginia, Georgia, Ohio, and Indiana; and as generally prevalent in Massachusetts, Connecticut, and Wisconsin. Although individual fields were in some cases rather badly infested, the total losses were small. It was said that in one field in Virginia the disease was especially heavy near affected pokeweed.

Angular leaf spot caused by Bacterium angulatum was said to be prevalent and very destructive in Virginia, causing a loss estimated at more than 10%. Some tobacco fields were abandoned on account of this disease.

"Wild fire" caused by Bacterium tabacum Wolf & Foster was also reported from Virginia. It was often associated with the angular leaf spot, but was not so generally distributed nor so important, although in some cases it was even more destructive. The loss caused by it was estimated at 2%.

Hollow stalk, thought to have been caused by Bacillus carotovorus Jones, was reported from Connecticut (one report).

Leaf spot caused by Cercospora nicotianae E. & E. was reported from Georgia as generally prevalent and as the most serious disease of tobacco in the state, causing a loss estimated at 5%.

Damping-off caused by Pythium debaryanum Hesse and Rhizoctonia sp. was reported from Ohio and Wisconsin. In the latter state it was considerably more abundant than usual in May and June, and caused a shortage of plants in many cases. Good seedlings were finally obtained from many beds which had been abandoned, however.

Fusarium wilt caused by Fusarium tabacivorum Del. was reported from Ohio as doubtfully present in one field.

Red root rot of undetermined cause, but thought to be due to a Fusarium or to Pythium, was reported from Connecticut as serious in several fields.

Root knot caused by Heterodera radicicola (Greef.) Müll. was reported from Ohio.

Potash hunger was said to be serious in certain fields in Connecticut.

Rust, of non-parasitic origin, was reported as following mosaic in Massachusets and Connecticut. In the former state it was said to be more common on the broadleaf type. This or a similar disease was also reported from Pennsylvania by field men of the Bureau of Crop Estimates.

Orobanche ludoviciana Nutt. was reported from Warren County, Ohio.

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